

# Appendix 6.1 Acoustic Glossary

## Appendix 6-1 Glossary

|              |                                                                                                                                                                                                                                                                                                                                                           |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Decibel, dB  | A unit of level derived from the logarithm of the ratio between the value of a quantity and a reference value. For sound pressure level ( $L_p$ ) the reference quantity is $2 \times 10^{-5} \text{ N/m}^2$ . The sound pressure level existing when microphone measured pressure is $2 \times 10^{-5} \text{ N/m}^2$ is 0 dB, the threshold of hearing. |
| L            | Instantaneous value of Sound Pressure Level ( $L_p$ ) or Sound Power Level ( $L_w$ ).                                                                                                                                                                                                                                                                     |
| Frequency    | Number of cycles per second, measured in Hertz (Hz), related to sound pitch.                                                                                                                                                                                                                                                                              |
| A weighting  | Arithmetic corrections applied to values of $L_p$ according to frequency. When logarithmically summed for all frequencies, the resulting single "A weighted value" becomes comparable with other such values from which a comparative loudness judgement can be made, then, without knowledge of frequency content of the source.                         |
| $L_{eq,T}$   | Equivalent continuous level of sound pressure which, if it actually existed for the integration time period T of the measurement, would possess the same energy as the constantly varying values of $L_p$ actually measured.                                                                                                                              |
| $L_{Aeq,T}$  | Equivalent continuous level of A weighted sound pressure which, if it actually existed for the integration time period, T, of the measurement would possess the same energy as the constantly varying values of $L_p$ actually measured.                                                                                                                  |
| $L_{n,T}$    | $L_p$ which was exceeded for n% of time, T.                                                                                                                                                                                                                                                                                                               |
| $L_{An,T}$   | Level in dBA which was exceeded for n% of time, T.                                                                                                                                                                                                                                                                                                        |
| $L_{max,T}$  | The instantaneous maximum sound pressure level which occurred during time, T.                                                                                                                                                                                                                                                                             |
| $L_{Amax,T}$ | The instantaneous maximum A weighted sound pressure level which occurred during time, T.                                                                                                                                                                                                                                                                  |

# Appendix 6.2 Legislation and Policy Summary

## Appendix 6-2 Legislation and Planning Policy

### Control of Pollution Act 1974

Section 60 of the Control of Pollution Act (COPA) states that Local Authorities can serve a notice imposing requirements on how the works are to be carried out, and if it deems necessary specify the following:

- the plant or machinery which is, or is not, to be used;
- the hours during which the works may be carried out;
- the level of noise which may be emitted from the premises in question, or at any specified point on those premises, or which may be so emitted during specified hours; and
- provide for any change of circumstances.

If the notice is not complied with, the Act includes the power to prosecute the person who “without reasonable excuse contravenes any requirement of the notice”.

### Environmental Protection Act 1990

Where it is deemed that a site is generating unnecessary and objectionable noise, the Environmental Protection Act provides the powers for a Local Authority to serve a Noise Abatement Notice.

The site which has been served with the abatement notice can claim that they use ‘Best Practicable Means’ (BPM) in order to control noise emitted from site, and that no further remedial works can be practically undertaken.

### National Planning Policy Framework (NPPF), 2019

National planning policies are detailed in the National Planning Policy Framework (NPPF), published by the Ministry of Housing, Communities & Local Government in April 2018.

This document provides little mention of planning policies relating to noise, with the exception of those detailed below (only relevant parts have been reproduced);

Paragraph 170 - “Planning policies and decisions should contribute to and enhance the natural and local environment by:

e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability”

Paragraph 180 – “Planning policies and decisions should also ensure that new development is appropriate for its location, taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

- a) mitigate, and reduce to a minimum, potential adverse impacts resulting from noise from new development, and avoid noise giving rise to significant adverse impacts on health and the quality of life;
- b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason."

### **Noise Policy Statement for England (NPSE), 2010**

The terms 'significant adverse' and 'adverse' above are referenced to the Noise Policy Statement for England (NPSE), published by Department for Environment, Food and Rural Affairs (DEFRA) dated March 2010. One of the main aims of this policy is to avoid significant adverse effects on health and quality of life.

With respect to the two terms above, the explanatory note for the NSPE introduces two concepts from toxicology that are currently being applied to noise impacts, for example, by the World Health Organisation (WHO). They are:

- NOEL – No Observed Effect Level - This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.
- LOAEL – Lowest Observed Adverse Effect Level - This is the level above which adverse effects on health and quality of life can be detected.

Extending these concepts for the purpose of this NPSE leads to the concept of a significant observed adverse effect level.

- SOAEL – Significant Observed Adverse Effect Level - This is the level above which significant adverse effects on health and quality of life occur. "

### **National Planning Practice Guidance (NPPG), 2012 revised July 2018**

NPPG brings together the aims of the NPPG and NPSE and tries to indicate how the likely perception and average response to noise relates to the effect levels. This is summarised in Table A11.2.1, below, replicated from the NPPG.

**Table A6.2.1: National Planning Policy Guidance - Noise**

| <b>Perception</b>                     | <b>Examples of outcomes</b>                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Increasing effect level</b>            | <b>Action</b>                    |
|---------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|----------------------------------|
| <b>Not noticeable</b>                 | No Effect                                                                                                                                                                                                                                                                                                                                                                                                                                                          | No Observed Effect                        | No specific measures required    |
| <b>Noticeable and not intrusive</b>   | Noise can be heard but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.                                                                                                                                                                                                                                                            | No Observed Adverse Effect                | No specific measures required    |
|                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Lowest Observed Adverse Effect Level      |                                  |
| <b>Noticeable and intrusive</b>       | Noise can be heard and causes small changes in behaviour and/or attitude, eg turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.                                                          | Observed Adverse Effect                   | Mitigate and reduce to a minimum |
|                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Significant Observed Adverse Effect Level |                                  |
| <b>Noticeable and disruptive</b>      | The noise causes a material change in behaviour and/or attitude, eg avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area. | Significant Observed Adverse Effect       | Avoid                            |
| <b>Noticeable and very disruptive</b> | Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, eg regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, eg auditory and non-auditory                                                                                                                                                                                 | Unacceptable Adverse Effect               | Prevent                          |

## Effect Levels

None of the policy documents provide noise level values for the different effect levels, instead stating that “The subjective nature of noise means that there is not a simple relationship between noise levels and the impact on those affected. This will depend on how various factors combine in any particular situation.”

These factors include:

- The source and absolute level of the noise together with the time of day it occurs. Some types and level of noise will cause a greater adverse effect at night than if they occurred during the day – this is because people tend to be more sensitive to noise at night as they are trying to sleep. The adverse effect can also be greater simply because there is less background noise at night;
- for non-continuous sources of noise, the number of noise events, and the frequency and pattern of occurrence of the noise;
- the spectral content of the noise (i.e. whether or not the noise contains particular high or low frequency content) and the general character of the noise (i.e. whether or not the noise contains particular tonal characteristics or other particular features). The local topology and topography should also be taken into account along with the existing and, where appropriate, the planned character of the area.

There are more specific factors to consider when relevant:

- where applicable, the cumulative impacts of more than one source should be taken into account along with the extent to which the source of noise is intermittent and of limited duration;
- consideration should also be given to whether adverse internal effects can be completely removed by closing windows and, in the case of new residential development, if the proposed mitigation relies on windows being kept closed most of the time. In both cases a suitable alternative means of ventilation is likely to be necessary.

## Manchester City Council – Planning & Noise Technical Guidance (December 2015)

This document sets out Manchester City Council’s requirements with regard to current guidance and policy, with the aspiration that new developments achieve the highest standards without compromising the health and wellbeing of residents. The guidance refers to the NPPF and NPSE as described below. The following requirements are considered relevant to this project;

Externally mounted ancillary plant, equipment and servicing shall be selected and/or acoustically treated in accordance with a scheme designed so as to achieve a BS 4142 rating level (see below) of 5 dB LAeq below the typical background LA90 level at the nearest noise sensitive location.

MCC offers no guidance on limits for noise intrusion to office buildings. As such, it is assumed that the design should control noise intrusion in line with BS 8233:2014, i.e. such that it is in the region of 35-50 dBLAeq,T.

# Appendix 6.3 Environmental Noise Survey Results



Mayfield Development Partnership

## **PLOT M, BARING STREET, OFFICE 2**

Environmental noise survey report





Mayfield Development Partnership

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## **PLOT M, BARING STREET, OFFICE 2**

Environmental noise survey report

**ENVIRONMENTAL NOISE SURVEY REPORT (FIRST ISSUE) CONFIDENTIAL**

**PROJECT NO. 70059652**

**OUR REF. NO. 70059652-27B-R01**

**DATE: SEPTEMBER 2019**

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# QUALITY CONTROL

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## ***APPENDICES***

### APPENDIX A

SUMMARY OF UNATTENDED NOISE MONITORING TO DETERMINE REPRESENTATIVE BACKGROUND

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SUMMARY OF EQUIPMENT USED FOR NOISE SURVEYS

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GLOSSARY OF TERMS

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LIMITATIONS OF REPORT

## 1 INTRODUCTION

WSP has been appointed to provide acoustic advice in relation to Plot M Baring Street, Office 2 (herein referred to as Plot M), Mayfield, Manchester.

The scheme consists of 10 floors of speculative office space along with space at ground and mezzanine level for retail units, café and auditorium/exhibition space.

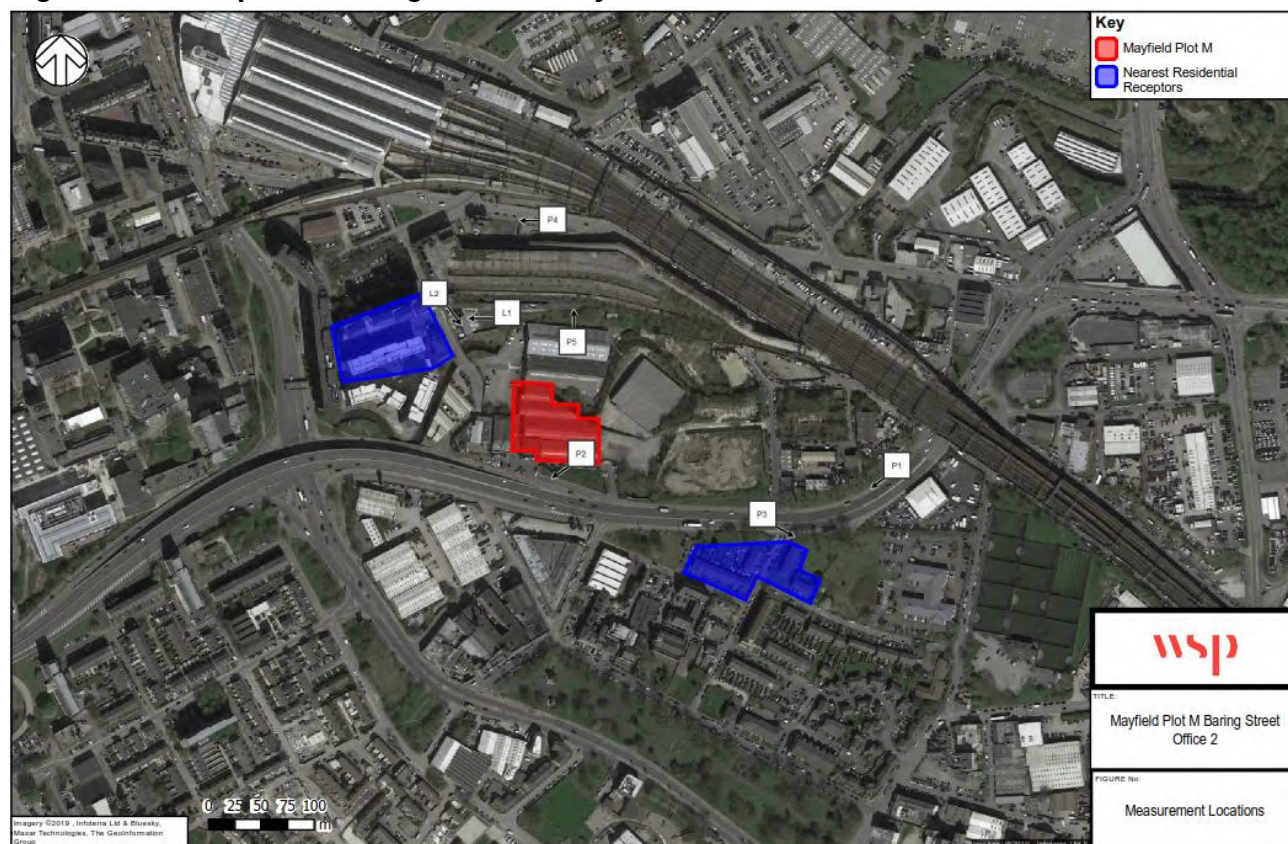
This report sets out the results of the environmental noise survey carried out at the site. It is to be read in conjunction with the Noise & Vibration Chapter of the EIA for the scheme (prepared by others).

## 2 SITE DESCRIPTION & PROPOSED DEVELOPMENT

Figure 2-1 shows the proposed location of Plot M.

The site is bounded by Mancunian Way to the south and the elevated train line leading into Piccadilly to the north. The site is undergoing redevelopment, with many of the existing buildings demolished.

**Figure 2-1 - Site plan showing noise survey measurement locations**



An outdoor food market 'GRUB' operates on the site between 12:00 hrs and 22:00 hrs on Fridays and Saturdays and 12:00 hrs and 18:00 hrs on Sunday to the North of the site, close to the Gatehouse building (Position L1). It is accessed from Baring Street.

The nearest noise sensitive receptors are considered to be the apartments and student accommodation to the west of the site on Baring Street and the houses and apartments on Potter Street and Cotter Street to the south, highlighted in blue in Figure 2-1.

## 3 CRITERIA

### 3.1 MANCHESTER CITY COUNCIL CRITERIA

#### EXTERNAL PLANT NOISE LIMITS

Manchester City Council's *Planning & Noise Technical Guidance (December 2015)* requires that:

*Externally mounted ancillary plant, equipment and servicing shall be selected and/or acoustically treated in accordance with a scheme designed so as to achieve a rating level of 5 dB ( $L_{Aeq}$ ) below the typical background ( $L_{A90}$ ) level at the nearest noise sensitive location.*

It notes that the rating level is to be determined based on the methodology set out in BS 4142:2014.

#### EMERGENCY PLANT NOISE LIMITS

For emergency plant items, that will only operate outside an emergency for short periods to be tested, a higher noise limit is typically permitted. It is understood that MCC permit a level 10 dB above the existing background sound level ( $L_{A90}$ ) at the nearest noise sensitive location.

#### MAXIMUM OPERATIONAL NOISE LIMITS

MCC specifies that:

*Entertainment noise ( $L_{Aeq}$ ) should be controlled to 10 dB below the background noise level ( $L_{A90}$ ) without the entertainment noise present, in each octave band at the nearest noise sensitive location.*

#### VIBRATION CRITERIA

MCC guidance requires that where developments are <75 m from a train or tram line, a vibration assessment is carried out.

Plot M is approximately 200 m from the elevated train line leading to Piccadilly Station and, therefore, MCC may not require a vibration survey to be undertaken.

### 3.2 BS4142:2014 METHODS FOR RATING AND ASSESSING INDUSTRIAL AND COMMERCIAL SOUND (+A1:2019)

BS 4142:2014 *Methods for rating and assessing industrial and commercial sound* (+A1:2019, herein referred to as BS4142:2014) provides typical guidance for assessing noise emissions from new items of building services plant against the existing background noise level at the nearest noise sensitive receptors.

It suggests that if the noise rating level is  $\geq 10$  dB higher than the existing background noise level ( $L_{A90}$  dB), it provides a likely indication of a significant adverse impact. If the level is 5 dB above the existing background noise level, it provides a likely indication of an adverse impact. Where the level doesn't exceed the background noise level it is an indication of having a low impact.

It also identifies that where noise contains 'attention catching features' such as bangs, whistles, etc or is intermittent, penalties should be applied in the noise assessment.

## 4 ENVIRONMENTAL NOISE SURVEY

### 4.1 OVERVIEW

An environmental noise survey was carried out between Friday 16 August and Tuesday 20 August 2019, comprising of attended and unattended measurements.

The existing site and measurement locations are shown on Figure 2-1.

#### UNATTENDED MEASUREMENTS

Unattended noise monitoring equipment was left to continually record noise from 10:00 hrs on Friday 16 August 2019 until 11:55 hrs on Tuesday 20 August 2019.

Two meters were installed on opposite sides of the building in first floor meeting rooms of The Gatehouse. The microphones of both extended approximately 1 m from the façade and were approximately 10 m above ground level. These are shown as locations L1 and L2 on Figure 2-1.

Position L1 was to the north-east of the site, screened from Baring Street but with a line of sight to the elevated train line leading into Piccadilly and Mancunian Way.

Position L1 also overlooks the outdoor food market, GRUB. The results of the noise monitoring at Position 1 show that the  $L_{A90,1hr}$  during these periods is 3-13 dB higher than the  $L_{A90,1hr}$  recorded in the daytime before GRUB opens.

On Saturday 17<sup>th</sup> August, a stage for Manchester Pride was erected along the eastern boundary of the Mayfield site and measurements at Position L1 may have also been affected by this.

Position L2 was facing Baring Street, opposite the Unite Student Accommodation building. It was completely screened from GRUB and the location where the Manchester Pride Stage was erected. The results of the measurements at L2 were reasonably consistent throughout the duration survey and are considered representative of the existing background levels at the student accommodation building opposite.

#### ATTENDED MEASUREMENTS

Attended measurements were taken at strategic locations around the site, shown as positions P1-P5 on Saturday 17 August 2019, Sunday 18 August 2019 and Tuesday 20 August 2019.

Night-time measurements were carried out at positions P1-P5 between 23:50 hrs on Saturday 17 August and 01:50 hrs on Sunday 18 August.

Day-time measurements were carried out at Positions P1-P3 between 11:12 hrs and 13:10 hrs on Tuesday 20 August 2019.

### 4.2 WEATHER CONDITIONS

There was heavy rainfall on Friday daytime and night and so the results from the unattended measurements for the 16 August 2019 have been omitted from the assessment.

Weather for the remainder of the noise survey was clear, with only intermittent rainfall on Monday 19 August 2019.

Weather reports for the area during the unattended measurements noted that the temperature ranged from 10°C to 16°C at night, and 13°C to 22°C during the day. Wind speeds were  $\leq 3$  m/s for the duration of the survey, with occasional gusts of up to 5 m/s.

Weather during the attended night-time measurements on Saturday 17 August through to Sunday 18 August 2019 was clear and dry. Temperature was 14°C and windspeeds were  $\leq 2$  m/s for the duration of the survey, with occasional gusts of up to 3 m/s. No rainfall occurred.

Weather during the attended daytime measurements on Tuesday 20 August 2019 was clear and dry. Temperature was 16°C and windspeeds were  $< 2$  m/s for the duration of the survey, with occasional gusts of up to 3 m/s. No rainfall occurred.

Other than the periods where rain occurred, which have been excluded from the assessment, the weather was considered suitable for obtaining representative noise data.

### 4.3 MEASUREMENT EQUIPMENT & PERSONNEL

Details of the measurement equipment is provided in Appendix B.

Unattended noise monitoring equipment was installed and collected by Ed Taylor.

Attended measurements were carried out by Ed Taylor and Aisha Ben Kahla on Saturday 17 and Sunday 18 August 2019, and by Ed Taylor on Tuesday 20 August 2019.

### 4.4 MEASUREMENT RESULTS

A summary of the measurement results is provided below.

#### UNATTENDED MEASUREMENTS

A summary of the ambient noise levels during the unattended measurements is provided in Table 4-1.

**Table 4-1 – Summary of ambient & maximum noise levels at unattended positions L1 & L2**

| Position | Date     | $L_{Aeq,16hrs}$ (dB)<br>Daytime<br>(07:00-23:00) | $L_{Aeq,8hrs}$ (dB)<br>Night-time<br>(23:00-07:00) | $L_{AFmax}$ (dB)**<br>Daytime<br>(07:00-23:00) | Night-time $L_{AFmax}$<br>(dB)** Night-time<br>(23:00-07:00) |
|----------|----------|--------------------------------------------------|----------------------------------------------------|------------------------------------------------|--------------------------------------------------------------|
| L1       | 17/8/19  | 66.5                                             | 54.0                                               | 82.9                                           | 65.3                                                         |
|          | 18/8/19  | 61.2                                             | 54.0                                               | 81.5                                           | 68.7                                                         |
|          | 19/8/19  | 63.0                                             | 52.5                                               | 84.1                                           | 64.4                                                         |
|          | 20/8/19* | 64.7                                             | -                                                  | 83.1                                           | -                                                            |
| L2       | 17/8/19  | 61.5                                             | 59.2                                               | 82.1                                           | 70.6                                                         |
|          | 18/8/19  | 58.4                                             | 58.9                                               | 82.7                                           | 72.9                                                         |
|          | 19/8/19  | 60.0                                             | 57.7                                               | 78.3                                           | 70.6                                                         |
|          | 20/8/19* | 66.9                                             | -                                                  | 82.6                                           | -                                                            |

\*Not over entire 16-hour due to measurement start & finish times

\*\* $L_{AFmax}$  not normally exceeded determined as 90<sup>th</sup> percentile of  $L_{AFmax,5mins}$

The representative background sound levels ( $L_{A90,T}$ , dB) have been determined based the guidance in MCC's *Planning & Noise Technical Guidance (December 2015)* and are summarised in Table 4-2.

The arithmetic average of each octave band, for each time period over the duration of the survey has been calculated. The minimum of the averages has then been used to determine the representative background sound level. Full details of the measured L90s during each 15 minute period at night and 1 hour period during the day are provided in Appendix A.

**Table 4-2 – Summary of representative background sound level (L90, dB)**

| Position | Period                    | Representative background noise level ( $L_{90,T}$ dB) at each octave band centre frequency (Hz) |      |      |      |      |      |      |      | Overall A-weighted level (dB) |
|----------|---------------------------|--------------------------------------------------------------------------------------------------|------|------|------|------|------|------|------|-------------------------------|
|          |                           | 63                                                                                               | 125  | 250  | 500  | 1k   | 2k   | 4k   | 8k   |                               |
| L1       | Daytime<br>07:00-23:00    | 53.0                                                                                             | 46.0 | 46.0 | 46.0 | 49.0 | 42.0 | 32.0 | 22.0 | 51.0 ( $L_{A90,1hr}$ )        |
|          | Night-time<br>23:00-07:00 | 48.0                                                                                             | 42.0 | 41.0 | 41.0 | 42.0 | 37.0 | 28.0 | 19.0 | 45.0 ( $L_{A90,15mins}$ )     |
| L2       | Daytime<br>07:00-23:00    | 56.0                                                                                             | 53.0 | 52.0 | 52.0 | 54.0 | 47.0 | 37.0 | 26.0 | 56.0 ( $L_{A90,1hr}$ )        |
|          | Night-time<br>23:00-07:00 | 51.0                                                                                             | 50.0 | 48.0 | 46.0 | 47.0 | 41.0 | 30.0 | 19.0 | 50.0 ( $L_{A90,15mins}$ )     |

## ATTENDED MEASUREMENTS

A summary of the sound pressure levels measured during the attended surveys at Positions P1-P5 is provided in Table 4-3

**Table 4-3 – Sound pressure levels from attended measurements at Positions P1-P5**

| Position | Date    | Start time | $L_{Aeq,5 mins}$ (dB) | $L_{AFmax,5 mins}$ (dB) | $L_{A90,5 mins}$ (dB) | Comments                                                                                                                                                                                            |
|----------|---------|------------|-----------------------|-------------------------|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| P5       | 17/8/19 | 23:52      | 57.4                  | 64.5                    | 54.1                  | Dominant noise source is traffic along Mancunian Way. Two sirens audible. Occasional rattle from light weight fencing. No music audible from Star & Garter.                                         |
|          |         | 23:57      | 59.5                  | 77.4                    | 55.8                  |                                                                                                                                                                                                     |
|          | 18/8/19 | 00:02      | 58.4                  | 65.7                    | 54.9                  |                                                                                                                                                                                                     |
| P4       | 18/8/19 | 00:16      | 64.1                  | 74.7                    | 55.0                  | No music audible from Star & Garter. Busy outside the pub with people talking. Trains are audible pulling in and out of Piccadilly. Traffic along Fairfield Street is fairly busy but not constant. |
|          |         | 00:21      | 63.6                  | 75.8                    | 55.5                  |                                                                                                                                                                                                     |
|          |         | 00:26      | 64.9                  | 87.5                    | 53.5                  |                                                                                                                                                                                                     |
| P2       | 18/8/19 | 00:44      | 71.1                  | 80.0                    | 56.1                  | Constant traffic along Mancunian Way is dominant noise source throughout.                                                                                                                           |
|          |         | 00:49      | 72.1                  | 84.4                    | 58.8                  |                                                                                                                                                                                                     |

| Position | Date    | Start time | $L_{Aeq,5 mins}$ (dB) | $L_{AFmax,5 mins}$ (dB) | $L_{A90,5 mins}$ (dB) | Comments                                                                                                                                                      |
|----------|---------|------------|-----------------------|-------------------------|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| P2       | 18/8/19 | 00:54      | 72.7                  | 85.1                    | 58.2                  | As position P2                                                                                                                                                |
| P3       | 18/8/19 | 01:06      | 72.9                  | 83.5                    | 62.1                  |                                                                                                                                                               |
|          |         | 01:11      | 74.4                  | 85.1                    | 63.5                  |                                                                                                                                                               |
|          |         | 01:16      | 73.7                  | 85.0                    | 61.7                  | As position P2, traffic along Mancunian Way dominates. Train movements into and out of Piccadilly are just audible.                                           |
| P1       | 18/8/19 | 01:23      | 72.4                  | 84.6                    | 60.0                  |                                                                                                                                                               |
|          |         | 01:26      | 72.6                  | 86.1                    | 53.3                  |                                                                                                                                                               |
|          |         | 01:33      | 72.1                  | 87.5                    | 54.7                  | Constant traffic along Mancunian Way. From 11:16-11:27 noise from demolition activities taking place to the north of the site. Traffic noise still dominates. |
| P2       | 20/8/19 | 11:12      | 75.7                  | 83.0                    | 71.1                  |                                                                                                                                                               |
|          |         | 11:17      | 76.2                  | 82.3                    | 70.6                  |                                                                                                                                                               |
|          |         | 11:22      | 76.1                  | 82.1                    | 71.0                  | As P2. Siren along Mancunian Way at 12:16 and 12:20. A train was visible at 12:20 but not audible.                                                            |
| P3       | 20/8/19 | 12:12      | 77.1                  | 93.5                    | 69.9                  |                                                                                                                                                               |
|          |         | 12:17      | 77.5                  | 92.4                    | 69.7                  |                                                                                                                                                               |
|          |         | 12:22      | 75.7                  | 85.6                    | 70.7                  | Constant traffic along Mancunian Way dominates throughout. At 13:00 there is a lull in traffic and a train passby is audible.                                 |
| P1       | 20/8/19 | 12:39      | 77.1                  | 86.0                    | 69.7                  |                                                                                                                                                               |
|          |         | 12:44      | 75.9                  | 86.8                    | 68.9                  |                                                                                                                                                               |
|          |         | 12:49      | 76.4                  | 86.5                    | 68.4                  |                                                                                                                                                               |
|          |         | 12:54      | 76.4                  | 87.1                    | 68.7                  |                                                                                                                                                               |
|          |         | 12:59      | 76.1                  | 84.5                    | 67.8                  |                                                                                                                                                               |
|          |         | 13:04      | 76.3                  | 87.0                    | 67.6                  |                                                                                                                                                               |

## 5 EXTERNAL PLANT

### 5.1 PLANT NOISE LIMITS

As noted previously, MCC requires that:

*Externally mounted ancillary plant, equipment and servicing shall be selected and/or acoustically treated in accordance with a scheme designed so as to achieve a rating level of 5 dB ( $L_{Aeq}$ ) below the typical background ( $L_{A90}$ ) level at the nearest noise sensitive location.*

It notes that the rating level is to be determined based on the methodology set out in BS 4142:2014, taking account of any penalties due to tonality, intermittency etc.

Based on the representative background noise level in Table 4-2, the resultant rating level from building services plant associated with the development should not exceed the limits in Table 5-1 at the nearest noise sensitive receptors.

The nearest noise sensitive receptors are considered to be the apartments to the west of the site on Baring Street. The representative background sound level from monitoring position L2 have been used to determine the rating level.

These limits are cumulative and include contribution from any tenant plant associated with the commercial units. Limits for individual tenancies shall be determined as the design progresses.

Once details of the plant selections and locations are known an assessment of the resultant rating level at the nearest noise sensitive receptor will be carried out. If required, attenuation measures will be provided to meet the limits in Table 5-1.

**Table 5-1 - Maximum noise rating level  $L_{Ar,Tr}$  (dB) from external plant, 1m from receptor**

| Period                   | Maximum rating noise level from external plant, 1 m from nearest noise sensitive receptor $L_{Ar,Tr}$ (dB) |
|--------------------------|------------------------------------------------------------------------------------------------------------|
| Daytime (07:00-23:00)    | 51                                                                                                         |
| Night-time (23:00-07:00) | 45                                                                                                         |

### EMERGENCY PLANT

Subject to approval by MCC, noise from emergency plant should be limited to no more than 15 dB higher than the criteria in Table 5-1, 1m from the nearest noise sensitive receptors. This equates to a level 10 dB above the existing representative background sound level.

To minimise the risk of disturbance, it is recommended that the testing of emergency plant only occurs during normal working hours, Monday-Friday (09:00-17:000). There shall be no testing of emergency plant on Sundays or public holidays.

## 6 OPERATIONAL NOISE

### EXTERNAL LIMITS

As noted previously, MCC requires that:

*Entertainment noise ( $L_{Aeq}$ ) should be controlled to 10 dB below the background noise level ( $L_{A90}$ ) without the entertainment noise present, in each octave band at the nearest noise sensitive location.*

This criterion applies to any operational noise (e.g. background music) associated with the development, for example; background music or amplified sound in the proposed retail, café and auditorium.

Based on the representative background noise levels in Table 4-2 for Position L2, operational noise associated with the development should not exceed the levels in Table 6-1, 1m from the nearest noise sensitive receptors.

**Table 6-1 – Maximum operational noise limits 1 m from the nearest noise sensitive receptors**

|                        | Maximum operation noise level ( $L_{eq}$ dB) at nearest noise sensitive receptor at each octave band centre frequency (Hz) |      |      |      |      |      |      |      |
|------------------------|----------------------------------------------------------------------------------------------------------------------------|------|------|------|------|------|------|------|
| Period                 | 63                                                                                                                         | 125  | 250  | 500  | 1k   | 2k   | 4k   | 8k   |
| Daytime 07:00-23:00    | 46.0                                                                                                                       | 43.0 | 42.0 | 42.0 | 44.0 | 37.0 | 27.0 | 16.0 |
| Night-time 23:00-07:00 | 41.0                                                                                                                       | 40.0 | 38.0 | 36.0 | 37.0 | 31.0 | 20.0 | 9.0  |

As the façade design develops, maximum internal operational noise limits for individual tenancies shall be determined based on the sound insulation performance such that noise egress from the development does not exceed these criteria.

# Appendix A

SUMMARY OF UNATTENDED NOISE  
MONITORING TO DETERMINE  
REPRESENTATIVE BACKGROUND





**Table A-1 – Position L1, measured  $L_{90,1hr}$  levels during daytime (07:00-23:00)**

| Date     | Time  | Measured $L_{90,1hr}$ (dB) at each octave band centre frequency |      |      |      |      |      |      |      | dBA  |
|----------|-------|-----------------------------------------------------------------|------|------|------|------|------|------|------|------|
|          |       | 63                                                              | 125  | 250  | 500  | 1k   | 2k   | 4k   | 8k   |      |
| 17/08/19 | 07:00 | 53                                                              | 45.9 | 47.1 | 48.3 | 50.1 | 44   | 35.5 | 26.8 | 52.6 |
|          | 08:00 | 57.6                                                            | 47.7 | 48.6 | 48.8 | 51.5 | 46   | 36.4 | 24.7 | 54.0 |
|          | 09:00 | 57.5                                                            | 46.7 | 47.7 | 47.5 | 50.6 | 44.5 | 35   | 23.2 | 52.9 |
|          | 10:00 | 59.4                                                            | 54.6 | 52.9 | 52   | 54.1 | 48.6 | 41.6 | 29.8 | 56.8 |
|          | 11:00 | 59.4                                                            | 54.8 | 52.8 | 52.5 | 53.8 | 47.8 | 39.9 | 30.4 | 56.6 |
|          | 12:00 | 58.6                                                            | 53.5 | 53.5 | 53.6 | 54.6 | 48.4 | 40.8 | 31.4 | 57.3 |
|          | 13:00 | 60.2                                                            | 57.2 | 57.6 | 59.7 | 58.7 | 53.1 | 46.5 | 36.5 | 62.1 |
|          | 14:00 | 62.2                                                            | 60.7 | 60.1 | 63   | 61.7 | 56.9 | 49.8 | 38.8 | 65.3 |
|          | 15:00 | 64.4                                                            | 60.9 | 61.4 | 64.3 | 62.8 | 57.8 | 51.1 | 39.1 | 66.4 |
|          | 16:00 | 60                                                              | 60.8 | 62.4 | 66.4 | 64.5 | 59.8 | 53   | 41.7 | 68.3 |
|          | 17:00 | 60.1                                                            | 61   | 63   | 67.9 | 66.6 | 62.1 | 55   | 43   | 70.2 |
|          | 18:00 | 59.6                                                            | 59.5 | 62.1 | 67.3 | 65.6 | 61.2 | 53.8 | 42.7 | 69.3 |
|          | 19:00 | 58.6                                                            | 56.7 | 61.3 | 66.9 | 64.8 | 60   | 52.6 | 41.1 | 68.5 |
|          | 20:00 | 58.2                                                            | 55.9 | 61   | 66.7 | 64.1 | 59.2 | 52.2 | 40.8 | 68.0 |
|          | 21:00 | 58.2                                                            | 58.4 | 59.8 | 63.7 | 61.9 | 57.1 | 50.2 | 40.3 | 65.6 |
|          | 22:00 | 57.4                                                            | 48.3 | 48.3 | 49.4 | 51.7 | 44.8 | 34.8 | 26.1 | 53.9 |
| 18/8/19  | 07:00 | 55.9                                                            | 44.1 | 44.3 | 43.8 | 46.6 | 39.7 | 28.6 | 19.1 | 48.8 |
|          | 08:00 | 57.1                                                            | 46.4 | 47.5 | 48.7 | 50.1 | 44   | 35.4 | 27.3 | 52.7 |
|          | 09:00 | 57.6                                                            | 49.5 | 50   | 50   | 52.5 | 46.8 | 39   | 28.9 | 55   |
|          | 10:00 | 62.7                                                            | 59.8 | 57.3 | 54.3 | 55   | 50.7 | 42.2 | 33.1 | 58.6 |
|          | 11:00 | 62.6                                                            | 59.5 | 58   | 55.1 | 56   | 51   | 42   | 32.7 | 59.3 |
|          | 12:00 | 62.8                                                            | 59.9 | 58.8 | 56.4 | 56.5 | 51.4 | 43.4 | 34.7 | 60.0 |
|          | 13:00 | 62.2                                                            | 60.3 | 59.5 | 58.9 | 58   | 53   | 45.2 | 35.6 | 61.6 |
|          | 14:00 | 61.7                                                            | 60.1 | 59.4 | 60.4 | 58.8 | 53.8 | 46   | 36.5 | 62.5 |
|          | 15:00 | 61.2                                                            | 60.4 | 59.7 | 60.2 | 58.9 | 54.1 | 46.8 | 36.8 | 62.6 |
|          | 16:00 | 60.9                                                            | 60   | 59   | 59   | 57.9 | 53   | 45.2 | 36   | 61.6 |
|          | 17:00 | 60.6                                                            | 59.8 | 58.3 | 58   | 57.2 | 52.2 | 44.3 | 35.2 | 60.8 |

| Date          | Time  | Measured $L_{90,1hr}$ (dB) at each octave band centre frequency |      |      |      |      |      |      |      | dBA  |
|---------------|-------|-----------------------------------------------------------------|------|------|------|------|------|------|------|------|
|               |       | 63                                                              | 125  | 250  | 500  | 1k   | 2k   | 4k   | 8k   |      |
|               | 18:00 | 55.3                                                            | 49   | 48.9 | 49.6 | 52.9 | 46.5 | 36.1 | 26.2 | 55.0 |
|               | 19:00 | 53.7                                                            | 47.5 | 46.9 | 47.4 | 50.8 | 43.8 | 32.2 | 20.5 | 52.8 |
|               | 20:00 | 53.5                                                            | 46.1 | 45.8 | 45.9 | 49.6 | 42.5 | 30.2 | 18.2 | 51.5 |
|               | 21:00 | 51.5                                                            | 45.1 | 45.1 | 45   | 48.8 | 41.7 | 29.3 | 17.3 | 50.7 |
|               | 22:00 | 50.8                                                            | 44   | 45   | 45.4 | 47.4 | 40.6 | 29.7 | 17.5 | 49.7 |
| 19/8/19       | 07:00 | 55.2                                                            | 47.6 | 48.7 | 49.5 | 54.1 | 47.5 | 34.4 | 19.6 | 55.9 |
|               | 08:00 | 58.9                                                            | 53   | 53.3 | 53   | 55.2 | 49.2 | 38.1 | 25.6 | 57.6 |
|               | 09:00 | 64.1                                                            | 59.9 | 59   | 56.8 | 56.7 | 53   | 45.8 | 35.9 | 60.6 |
|               | 10:00 | 63.3                                                            | 59.2 | 57.1 | 55   | 55.1 | 50.9 | 43   | 32.1 | 58.8 |
|               | 11:00 | 63.5                                                            | 59.3 | 57.8 | 56   | 55.4 | 51.1 | 43   | 31.9 | 59.3 |
|               | 12:00 | 64.5                                                            | 60.3 | 59.1 | 57.4 | 57   | 53.1 | 46.6 | 36.3 | 60.9 |
|               | 13:00 | 63.2                                                            | 59.3 | 57.2 | 55.5 | 55.9 | 51.9 | 44.5 | 34.2 | 59.5 |
|               | 14:00 | 65.1                                                            | 58.7 | 58   | 58.3 | 58.5 | 54.8 | 47.9 | 38   | 62.1 |
|               | 15:00 | 65.4                                                            | 60.7 | 60.2 | 59   | 58.2 | 54.1 | 47.3 | 36.7 | 62.1 |
|               | 16:00 | 64.9                                                            | 56.9 | 56   | 53.7 | 54.1 | 49.3 | 39.6 | 28.7 | 57.5 |
|               | 17:00 | 64.8                                                            | 57.2 | 56.5 | 53.6 | 53.7 | 49.4 | 40.1 | 29.4 | 57.4 |
|               | 18:00 | 56.1                                                            | 49.6 | 50.3 | 51.2 | 53.6 | 48.1 | 36.4 | 25.9 | 56   |
| Excluded rain | 19:00 | 52.7                                                            | 46.9 | 47.6 | 48.4 | 50.8 | 46.2 | 37.5 | 26.8 | 53.5 |
|               | 20:00 | 51.3                                                            | 45.2 | 46.1 | 46.6 | 50.3 | 44.5 | 34.4 | 25.8 | 52.5 |
|               | 21:00 | 51                                                              | 44.9 | 45.5 | 46   | 49.9 | 43.8 | 32.5 | 23.4 | 51.9 |
|               | 22:00 | 51.1                                                            | 44.1 | 43.8 | 44   | 47.2 | 40.9 | 31   | 22.8 | 49.4 |
| 20/08/19      | 07:00 | 56.5                                                            | 48.4 | 50.1 | 51.3 | 55.1 | 48.8 | 37.2 | 25.4 | 57.1 |
|               | 08:00 | 65.2                                                            | 60.7 | 58.1 | 56.7 | 57.6 | 53.3 | 45.7 | 35   | 61.0 |
|               | 09:00 | 64.5                                                            | 60.5 | 58.4 | 56.8 | 57   | 53   | 45.5 | 35   | 60.7 |
|               | 10:00 | 64.5                                                            | 61.6 | 61.1 | 56.5 | 56.9 | 53.2 | 46.3 | 35.6 | 61.0 |
|               | 11:00 | 64.8                                                            | 59.9 | 58.8 | 56.9 | 56.8 | 52.6 | 45.1 | 34   | 60.5 |

**Table A-2 – Arithmetic average measured  $L_{90,1hr}$  levels during daytime (07:00-23:00) L1**

|  | Time    | Arithmetic average of $L_{90,1hr}$ (dB) at each octave band centre frequency |      |      |      |      |      |      |      | dBA  |
|--|---------|------------------------------------------------------------------------------|------|------|------|------|------|------|------|------|
|  |         | 63                                                                           | 125  | 250  | 500  | 1k   | 2k   | 4k   | 8k   |      |
|  | 07:00   | 55.2                                                                         | 46.5 | 47.6 | 48.2 | 51.5 | 45.0 | 33.9 | 22.7 | 53.6 |
|  | 08:00   | 59.7                                                                         | 52.0 | 51.9 | 51.8 | 53.6 | 48.1 | 38.9 | 28.2 | 56.3 |
|  | 09:00   | 60.9                                                                         | 54.2 | 53.8 | 52.8 | 54.2 | 49.3 | 41.3 | 30.8 | 57.2 |
|  | 10:00   | 62.5                                                                         | 58.8 | 57.1 | 54.5 | 55.3 | 50.9 | 43.3 | 32.7 | 58.8 |
|  | 11:00   | 62.6                                                                         | 58.4 | 56.9 | 55.1 | 55.5 | 50.6 | 42.5 | 32.3 | 58.9 |
|  | 12:00   | 62.0                                                                         | 57.9 | 57.1 | 55.8 | 56.0 | 51.0 | 43.6 | 34.1 | 59.4 |
|  | 13:00   | 61.9                                                                         | 58.9 | 58.1 | 58.0 | 57.5 | 52.7 | 45.4 | 35.4 | 61.0 |
|  | 14:00   | 63.0                                                                         | 59.8 | 59.2 | 60.6 | 59.7 | 55.2 | 47.9 | 37.8 | 63.3 |
|  | 15:00   | 63.7                                                                         | 60.7 | 60.4 | 61.2 | 60.0 | 55.3 | 48.4 | 37.5 | 63.7 |
|  | 16:00   | 61.9                                                                         | 59.2 | 59.1 | 59.7 | 58.8 | 54.0 | 45.9 | 35.5 | 62.4 |
|  | 17:00   | 61.8                                                                         | 59.3 | 59.3 | 59.8 | 59.2 | 54.6 | 46.5 | 35.9 | 62.7 |
|  | 18:00   | 57.0                                                                         | 52.7 | 53.8 | 56.0 | 57.4 | 51.9 | 42.1 | 31.6 | 60.0 |
|  | 19:00   | 56.2                                                                         | 52.1 | 54.1 | 57.2 | 57.8 | 51.9 | 42.4 | 30.8 | 60.5 |
|  | 20:00   | 54.3                                                                         | 49.1 | 51.0 | 53.1 | 54.7 | 48.7 | 38.9 | 28.3 | 57.1 |
|  | 21:00   | 53.6                                                                         | 49.5 | 50.1 | 51.6 | 53.5 | 47.5 | 37.3 | 27.0 | 55.9 |
|  | 22:00   | 53.1                                                                         | 45.5 | 45.7 | 46.3 | 48.8 | 42.1 | 31.8 | 22.1 | 51.0 |
|  | Minimum | 53.1                                                                         | 45.5 | 45.7 | 46.3 | 48.8 | 42.1 | 31.8 | 22.1 | 51.0 |

**Table A-3 – Position L2, measured  $L_{90,1hr}$  levels during daytime (07:00-23:00)**

| Date     | Time  | Measured $L_{90,1hr}$ (dB) at each octave band centre frequency |      |      |      |      |      |      |      | dBA  |
|----------|-------|-----------------------------------------------------------------|------|------|------|------|------|------|------|------|
|          |       | 63                                                              | 125  | 250  | 500  | 1k   | 2k   | 4k   | 8k   |      |
| 17/08/19 | 07:00 | 56.8                                                            | 54.7 | 52.9 | 53.8 | 55   | 48.2 | 39.1 | 30.6 | 57.5 |
|          | 08:00 | 56.7                                                            | 52.8 | 52.4 | 51.9 | 55.4 | 48.4 | 36.6 | 23   | 57.4 |
|          | 09:00 | 56.5                                                            | 53   | 52.6 | 52.2 | 55.5 | 47.8 | 35.8 | 22.2 | 57.4 |
|          | 10:00 | 58.9                                                            | 55.8 | 54.8 | 54.1 | 56.9 | 49.3 | 37.9 | 25.1 | 59   |
|          | 11:00 | 58.9                                                            | 55.3 | 55.1 | 54.7 | 57.2 | 49.5 | 38.2 | 25.2 | 59.3 |
|          | 12:00 | 59.4                                                            | 56.7 | 56.4 | 56.2 | 58.3 | 50.4 | 39.9 | 29.6 | 60.4 |
|          | 13:00 | 60.2                                                            | 57.2 | 57.6 | 58.1 | 59.3 | 51.5 | 41.6 | 31.9 | 61.6 |
|          | 14:00 | 61.5                                                            | 59.4 | 58.7 | 59.7 | 60.5 | 53.1 | 43.5 | 33.3 | 63   |
|          | 15:00 | 61.4                                                            | 58.9 | 59.2 | 60.4 | 61.5 | 54   | 44.4 | 33.5 | 63.9 |
|          | 16:00 | 60.3                                                            | 58.8 | 59.3 | 61.5 | 61.6 | 54.5 | 45   | 34.1 | 64.3 |
|          | 17:00 | 61.2                                                            | 58.9 | 59.7 | 63   | 62.8 | 56.7 | 47.8 | 36.3 | 65.7 |
|          | 18:00 | 59.8                                                            | 58.6 | 58.9 | 62   | 61.6 | 55.1 | 45.7 | 34.5 | 64.5 |
|          | 19:00 | 58.9                                                            | 57.2 | 58.8 | 62.1 | 61.8 | 54.9 | 45.2 | 33.9 | 64.6 |
|          | 20:00 | 57.8                                                            | 56.4 | 58   | 61.7 | 60.5 | 53.9 | 45.2 | 33.9 | 63.6 |
|          | 21:00 | 57.8                                                            | 58   | 58   | 59.8 | 59.6 | 52.8 | 43.2 | 32.8 | 62.4 |
|          | 22:00 | 57.1                                                            | 55.7 | 53.5 | 54.3 | 56   | 48.8 | 38.8 | 30.9 | 58.3 |
| 18/8/19  | 07:00 | 53.2                                                            | 50.9 | 49   | 48.1 | 50.8 | 43.3 | 31.6 | 19.8 | 52.9 |
|          | 08:00 | 55.6                                                            | 54.7 | 52.2 | 53.1 | 53.4 | 46.5 | 37.8 | 30.9 | 56.2 |
|          | 09:00 | 56                                                              | 52.9 | 51.8 | 51.2 | 54.3 | 46.8 | 36.3 | 25.8 | 56.3 |
|          | 10:00 | 59.3                                                            | 55.6 | 54.6 | 54.1 | 56.3 | 48.5 | 37.3 | 26.6 | 58.5 |
|          | 11:00 | 59.8                                                            | 56.6 | 55.8 | 55.3 | 57.6 | 49.5 | 38.3 | 27.8 | 59.7 |
|          | 12:00 | 60.2                                                            | 56.7 | 56.6 | 56.2 | 57.8 | 49.7 | 38.8 | 27.9 | 60.1 |
|          | 13:00 | 60.6                                                            | 57.2 | 56.8 | 57.3 | 58.4 | 50.7 | 40.3 | 31   | 60.8 |
|          | 14:00 | 60.4                                                            | 56.8 | 56.7 | 57.3 | 58.8 | 51   | 40   | 29   | 61   |
|          | 15:00 | 59.9                                                            | 57.1 | 56.8 | 57.5 | 57.8 | 50.4 | 40.7 | 31.3 | 60.5 |
|          | 16:00 | 59.9                                                            | 57.4 | 56.9 | 57.6 | 58.4 | 50.8 | 40.7 | 31.7 | 60.9 |
|          | 17:00 | 60.2                                                            | 56.9 | 56.1 | 56.7 | 58.1 | 50.4 | 39.8 | 30.3 | 60.4 |
|          | 18:00 | 59.4                                                            | 53.9 | 54.5 | 54.4 | 57.4 | 50.2 | 39   | 28.2 | 59.4 |

| Date          | Time  | Measured $L_{90,1hr}$ (dB) at each octave band centre frequency |      |      |      |      |      |      |      | dBA  |
|---------------|-------|-----------------------------------------------------------------|------|------|------|------|------|------|------|------|
|               |       | 63                                                              | 125  | 250  | 500  | 1k   | 2k   | 4k   | 8k   |      |
|               | 19:00 | 59                                                              | 52.8 | 53.4 | 53.7 | 56.7 | 49.9 | 39.2 | 27.8 | 58.8 |
|               | 20:00 | 57.5                                                            | 52.3 | 52.2 | 52.3 | 55.8 | 48.8 | 37   | 26.2 | 57.8 |
|               | 21:00 | 55.8                                                            | 51.9 | 51.1 | 50.8 | 54   | 46.7 | 35   | 23.2 | 56   |
|               | 22:00 | 55.5                                                            | 51.8 | 50.8 | 50.9 | 52.5 | 45.6 | 36.2 | 25   | 54.9 |
| 19/8/19       | 07:00 | 57.8                                                            | 54.1 | 55   | 55.1 | 59.7 | 52.7 | 40.1 | 24.8 | 61.5 |
|               | 08:00 | 59.5                                                            | 55.8 | 56.3 | 56.2 | 59.6 | 52.6 | 41   | 26.3 | 61.6 |
|               | 09:00 | 60.4                                                            | 56.8 | 56.5 | 56.2 | 58.6 | 52   | 41.4 | 27.8 | 60.9 |
|               | 10:00 | 61.2                                                            | 56.6 | 55.9 | 55.5 | 57.6 | 51   | 40.6 | 27.6 | 60   |
|               | 11:00 | 62.2                                                            | 57.1 | 56.9 | 56.8 | 58.7 | 51.8 | 42.9 | 32.9 | 61.1 |
|               | 12:00 | 62.3                                                            | 57.6 | 57.6 | 57.4 | 58.3 | 52.2 | 42.9 | 32.9 | 61.1 |
|               | 13:00 | 60.4                                                            | 56.6 | 56.2 | 56.3 | 58.2 | 52.8 | 43.7 | 32.6 | 60.9 |
|               | 14:00 | 60.4                                                            | 56.2 | 56.1 | 56.1 | 58.5 | 51.3 | 40.2 | 26.3 | 60.7 |
|               | 15:00 | 61.4                                                            | 57.3 | 57.1 | 56.7 | 58.9 | 51.2 | 39.7 | 25.9 | 61   |
|               | 16:00 | 60                                                              | 55.3 | 55.6 | 55.2 | 58   | 49.9 | 37.5 | 23.7 | 59.9 |
|               | 17:00 | 61                                                              | 55.9 | 55.9 | 56.1 | 57.2 | 50.4 | 40.5 | 28.5 | 59.8 |
|               | 18:00 | 60.8                                                            | 54.8 | 55.6 | 56.2 | 58.5 | 50.9 | 40   | 30   | 60.6 |
| Excluded rain | 19:00 | 56.4                                                            | 53.5 | 53.5 | 54   | 56.2 | 50.5 | 40.8 | 28.4 | 58.7 |
|               | 20:00 | 54.7                                                            | 52.3 | 51.9 | 51.8 | 55.2 | 48.7 | 36.9 | 22.3 | 57.3 |
|               | 21:00 | 55.5                                                            | 52.8 | 52   | 52.1 | 55.2 | 48.6 | 36.6 | 21.4 | 57.3 |
|               | 22:00 | 55.3                                                            | 52   | 50.8 | 50.7 | 53.4 | 47   | 36   | 21.8 | 55.7 |
| 20/08/19      | 07:00 | 59.6                                                            | 55.9 | 56.3 | 56.7 | 60.2 | 53.4 | 41.8 | 30.4 | 62.2 |
|               | 08:00 | 62.6                                                            | 57.8 | 58.1 | 58.4 | 61.1 | 54.6 | 44.8 | 33.8 | 63.3 |
|               | 09:00 | 62.1                                                            | 57.2 | 57.4 | 57.1 | 59.6 | 52.7 | 41.8 | 28.5 | 61.8 |
|               | 10:00 | 63                                                              | 57.7 | 57.5 | 57   | 59.7 | 53.3 | 44   | 32.4 | 62   |
|               | 11:00 | 65                                                              | 57.5 | 57.7 | 57.9 | 59.8 | 53.5 | 44.9 | 34.2 | 62.3 |

**Table A-4 – Arithmetic average measured  $L_{90,1hr}$  levels during daytime (07:00-23:00) L2**

|  | Time    | Arithmetic average of $L_{90,1hr}$ (dB) at each octave band centre frequency |      |      |      |      |      |      |      | dBA  |
|--|---------|------------------------------------------------------------------------------|------|------|------|------|------|------|------|------|
|  |         | 63                                                                           | 125  | 250  | 500  | 1k   | 2k   | 4k   | 8k   |      |
|  | 07:00   | 56.9                                                                         | 53.9 | 53.3 | 53.4 | 56.4 | 49.4 | 38.2 | 26.4 | 58.5 |
|  | 08:00   | 58.6                                                                         | 55.3 | 54.8 | 54.9 | 57.4 | 50.5 | 40.1 | 28.5 | 59.6 |
|  | 09:00   | 58.8                                                                         | 55.0 | 54.6 | 54.2 | 57.0 | 49.8 | 38.8 | 26.1 | 59.1 |
|  | 10:00   | 60.6                                                                         | 56.4 | 55.7 | 55.2 | 57.6 | 50.5 | 40.0 | 27.9 | 59.8 |
|  | 11:00   | 61.5                                                                         | 56.6 | 56.4 | 56.2 | 58.3 | 51.1 | 41.1 | 30.0 | 60.6 |
|  | 12:00   | 60.6                                                                         | 57.0 | 56.9 | 56.6 | 58.1 | 50.8 | 40.5 | 30.1 | 60.5 |
|  | 13:00   | 60.4                                                                         | 57.0 | 56.9 | 57.2 | 58.6 | 51.7 | 41.9 | 31.8 | 61.1 |
|  | 14:00   | 60.8                                                                         | 57.5 | 57.2 | 57.7 | 59.3 | 51.8 | 41.2 | 29.5 | 61.6 |
|  | 15:00   | 60.9                                                                         | 57.8 | 57.7 | 58.2 | 59.4 | 51.9 | 41.6 | 30.2 | 61.8 |
|  | 16:00   | 60.1                                                                         | 57.2 | 57.3 | 58.1 | 59.3 | 51.7 | 41.1 | 29.8 | 61.7 |
|  | 17:00   | 60.8                                                                         | 57.2 | 57.2 | 58.6 | 59.4 | 52.5 | 42.7 | 31.7 | 61.9 |
|  | 18:00   | 60.0                                                                         | 55.8 | 56.3 | 57.5 | 59.2 | 52.1 | 41.6 | 30.9 | 61.5 |
|  | 19:00   | 59.0                                                                         | 55.0 | 56.1 | 57.9 | 59.3 | 52.4 | 42.2 | 30.9 | 61.6 |
|  | 20:00   | 56.7                                                                         | 53.7 | 54.0 | 55.3 | 57.2 | 50.5 | 39.7 | 27.5 | 59.5 |
|  | 21:00   | 56.4                                                                         | 54.2 | 53.7 | 54.2 | 56.3 | 49.4 | 38.3 | 25.8 | 58.5 |
|  | 22:00   | 56.0                                                                         | 53.2 | 51.7 | 52.0 | 54.0 | 47.1 | 37.0 | 25.9 | 56.3 |
|  | Minimum | 56.0                                                                         | 53.2 | 51.7 | 52.0 | 54.0 | 47.1 | 37.0 | 25.8 | 56.3 |



**Table A-5 – Position L1, measured  $L_{90,15\text{ min}}$  levels during night-time (23:00-07:00)**

| Date     | Time  | Measured $L_{90,15\text{min}}$ (dB) at each octave band centre frequency |      |      |      |      |      |      |      | dBA  |
|----------|-------|--------------------------------------------------------------------------|------|------|------|------|------|------|------|------|
|          |       | 63                                                                       | 125  | 250  | 500  | 1k   | 2k   | 4k   | 8k   |      |
| 17/08/19 | 00:00 | 48.9                                                                     | 43.7 | 44.8 | 44.1 | 47.1 | 41.4 | 33.4 | 26.2 | 49.5 |
|          | 00:15 | 48.5                                                                     | 43.5 | 43.5 | 43.4 | 46.5 | 40.6 | 33   | 26   | 48.8 |
|          | 00:30 | 48.4                                                                     | 43.2 | 43.3 | 43.4 | 46.3 | 40.6 | 33.1 | 26   | 48.7 |
|          | 00:45 | 50.3                                                                     | 43.6 | 45.5 | 47.1 | 47.4 | 41.8 | 35.7 | 28.3 | 50.4 |
|          | 01:00 | 49.7                                                                     | 43.3 | 45.1 | 46.7 | 47.1 | 41.1 | 35.3 | 27.7 | 50.0 |
|          | 01:15 | 51.6                                                                     | 44   | 44.8 | 46.3 | 45.9 | 40.5 | 34.8 | 27.1 | 49.2 |
|          | 01:30 | 55.6                                                                     | 43.9 | 44.6 | 46.4 | 46.1 | 40.3 | 34.5 | 26.9 | 49.3 |
|          | 01:45 | 47.3                                                                     | 43   | 42.6 | 42.8 | 45.3 | 39.8 | 31.8 | 23.1 | 47.8 |
|          | 02:00 | 46.2                                                                     | 42.5 | 42.1 | 42   | 44.8 | 39.1 | 30.8 | 22.4 | 47.2 |
|          | 02:15 | 46                                                                       | 42.4 | 41.6 | 41.4 | 43.7 | 38   | 30.1 | 22   | 46.3 |
|          | 02:30 | 46.7                                                                     | 42.6 | 42.2 | 42.5 | 44.4 | 38.6 | 30.1 | 21.7 | 47.0 |
|          | 02:45 | 46.3                                                                     | 42.6 | 41.6 | 41.3 | 43.2 | 37.4 | 29.6 | 21.4 | 45.8 |
|          | 03:00 | 46.5                                                                     | 43   | 41.6 | 41.4 | 42.9 | 37.1 | 29.5 | 21.3 | 45.6 |
|          | 03:15 | 47.2                                                                     | 44.7 | 42.3 | 42.1 | 44.2 | 38.5 | 29.8 | 21.4 | 46.8 |
|          | 03:30 | 47.6                                                                     | 43.8 | 42.2 | 41.9 | 43.8 | 38   | 29.4 | 21.2 | 46.4 |
|          | 03:45 | 47.8                                                                     | 44.2 | 42.8 | 42.1 | 43.9 | 38   | 29.7 | 21.4 | 46.6 |
|          | 04:00 | 47.6                                                                     | 43.8 | 42.9 | 42   | 43.7 | 37.6 | 29.7 | 21.5 | 46.4 |
|          | 04:15 | 47                                                                       | 43.4 | 43.1 | 42.8 | 44.9 | 38.7 | 30   | 21.4 | 47.4 |
|          | 04:30 | 48.5                                                                     | 44.6 | 44.4 | 44.7 | 48.2 | 41.9 | 30.9 | 21.6 | 50.3 |
|          | 04:45 | 51                                                                       | 44.6 | 45.1 | 45   | 48.3 | 41.9 | 31.3 | 21.9 | 50.4 |
|          | 05:00 | 51.6                                                                     | 45.1 | 45.1 | 44.1 | 47   | 40.9 | 31   | 21.7 | 49.3 |
|          | 05:15 | 50.5                                                                     | 44.4 | 45.4 | 45.4 | 48.6 | 42.1 | 31.3 | 21.5 | 50.7 |
|          | 05:30 | 51.6                                                                     | 45.6 | 46.6 | 47.1 | 50.4 | 44.1 | 32.8 | 21.9 | 52.5 |
|          | 05:45 | 53                                                                       | 45.6 | 47.4 | 48.8 | 50.1 | 44.1 | 36   | 27.5 | 52.7 |
|          | 06:00 | 49.2                                                                     | 44.1 | 44.6 | 45.1 | 48.6 | 42.8 | 34   | 26.7 | 50.8 |
|          | 06:15 | 51                                                                       | 43.9 | 44.3 | 44.4 | 47.7 | 44.4 | 35.3 | 26.8 | 50.7 |
|          | 06:30 | 51.2                                                                     | 45.1 | 45.4 | 45.1 | 48.5 | 42.6 | 34.1 | 26.8 | 50.8 |
|          | 06:45 | 53.3                                                                     | 44.1 | 45   | 44.6 | 47.7 | 41.8 | 33.7 | 26.4 | 50.0 |

| Date     | Time  | Measured $L_{90,15\text{min}}$ (dB) at each octave band centre frequency |      |      |      |      |      |      |      | dBA  |
|----------|-------|--------------------------------------------------------------------------|------|------|------|------|------|------|------|------|
|          |       | 63                                                                       | 125  | 250  | 500  | 1k   | 2k   | 4k   | 8k   |      |
| 18/08/19 | 23:00 | 56.8                                                                     | 47   | 47.2 | 47.3 | 50.3 | 43.6 | 32.2 | 22.3 | 52.4 |
|          | 23:15 | 56.5                                                                     | 46.4 | 46.9 | 47   | 50.3 | 43.1 | 31.2 | 21.1 | 52.3 |
|          | 23:30 | 56.5                                                                     | 46.4 | 46.6 | 46.4 | 49.7 | 42.1 | 29.7 | 19.6 | 51.6 |
|          | 23:45 | 56.3                                                                     | 46.3 | 46.4 | 45.9 | 49.1 | 42.4 | 30   | 19.6 | 51.2 |
|          | 00:00 | 56.4                                                                     | 45.8 | 46.3 | 46.2 | 49.3 | 42.6 | 30.2 | 19.5 | 51.4 |
|          | 00:15 | 56.3                                                                     | 45.7 | 45.4 | 45   | 48.1 | 41   | 29.1 | 19   | 50.2 |
|          | 00:30 | 56.3                                                                     | 46   | 45.5 | 44.9 | 48.2 | 41.2 | 29.4 | 19.4 | 50.3 |
|          | 00:45 | 56.2                                                                     | 45.5 | 44.9 | 44.5 | 47.3 | 40   | 28.5 | 19.2 | 49.4 |
|          | 01:00 | 56                                                                       | 45   | 44.5 | 43.9 | 46.6 | 39.4 | 28.2 | 18.8 | 48.8 |
|          | 01:15 | 55.5                                                                     | 44.8 | 44.4 | 44   | 46.5 | 39.7 | 28.8 | 19.6 | 48.8 |
|          | 01:30 | 55.5                                                                     | 44.5 | 43.6 | 43.3 | 46   | 38.8 | 27.8 | 18.6 | 48.2 |
|          | 01:45 | 55.5                                                                     | 44.8 | 43.3 | 42.9 | 45.7 | 38.6 | 27.9 | 19   | 47.9 |
|          | 02:00 | 55.5                                                                     | 45.1 | 44.2 | 43.9 | 47.3 | 40.1 | 28.6 | 19.4 | 49.3 |
|          | 02:15 | 55.4                                                                     | 43.8 | 43   | 42.5 | 45.2 | 38.3 | 27.6 | 18.7 | 47.4 |
|          | 02:30 | 55.4                                                                     | 43.9 | 43.1 | 42.8 | 45.3 | 41.7 | 31   | 19.3 | 48.3 |
|          | 02:45 | 55.2                                                                     | 43.9 | 42.6 | 42   | 44.3 | 37.3 | 27.6 | 19   | 46.6 |
|          | 03:00 | 55.7                                                                     | 43.9 | 45   | 47.2 | 45.8 | 39.5 | 34.3 | 27.4 | 49.2 |
|          | 03:15 | 55.5                                                                     | 44.5 | 45   | 46.5 | 46.8 | 40.4 | 33.8 | 26.6 | 49.7 |
|          | 03:30 | 55.6                                                                     | 44.3 | 44.6 | 46   | 46.2 | 39.7 | 33.2 | 26.2 | 49.1 |
|          | 03:45 | 55.6                                                                     | 44.4 | 44.3 | 45.5 | 45.2 | 38.7 | 32.9 | 25.8 | 48.3 |
|          | 04:00 | 55.1                                                                     | 44.1 | 43.2 | 44.1 | 44.4 | 38   | 29.5 | 21.1 | 47.3 |
|          | 04:15 | 55                                                                       | 42.7 | 42.1 | 41.9 | 44   | 37.3 | 27.5 | 18.9 | 46.4 |
|          | 04:30 | 55                                                                       | 42.9 | 41.9 | 41.3 | 42.9 | 36.3 | 27.5 | 19.1 | 45.5 |
|          | 04:45 | 54.9                                                                     | 42.6 | 41.3 | 40.9 | 42.2 | 35.8 | 27   | 18.9 | 44.9 |
|          | 05:00 | 54.8                                                                     | 43.1 | 41.8 | 40.9 | 42.5 | 36   | 27.5 | 19.1 | 45.2 |
|          | 05:15 | 55.2                                                                     | 43.5 | 42.1 | 41.2 | 43.3 | 36.7 | 27.4 | 18.8 | 45.8 |
|          | 05:30 | 55.2                                                                     | 43.5 | 42.7 | 42.4 | 45.4 | 38.7 | 28.1 | 19.1 | 47.6 |
|          | 05:45 | 55                                                                       | 43.6 | 43.2 | 42.6 | 45.6 | 38.7 | 28.2 | 19   | 47.8 |

| Date          | Time  | Measured $L_{90,15min}$ (dB) at each octave band centre frequency |      |      |      |      |      |      |      | dBA  |
|---------------|-------|-------------------------------------------------------------------|------|------|------|------|------|------|------|------|
|               |       | 63                                                                | 125  | 250  | 500  | 1k   | 2k   | 4k   | 8k   |      |
|               | 06:00 | 55                                                                | 43.2 | 42.2 | 41.5 | 44.1 | 37.4 | 27.5 | 19   | 46.4 |
|               | 06:15 | 55.3                                                              | 44.3 | 43.3 | 42.7 | 45.1 | 38.3 | 27.8 | 19   | 47.4 |
|               | 06:30 | 56.1                                                              | 45.7 | 45.3 | 44.4 | 47.1 | 40.1 | 28.7 | 19.3 | 49.3 |
|               | 06:45 | 55.8                                                              | 44.1 | 43.4 | 42.4 | 44.1 | 37.8 | 28.3 | 19.3 | 46.8 |
| 19/08/19      | 23:00 | 50.3                                                              | 43.7 | 45.3 | 46.3 | 47.3 | 40.8 | 33.2 | 25.6 | 49.9 |
|               | 23:15 | 49.7                                                              | 43.4 | 44.6 | 45.8 | 45.9 | 39.7 | 33   | 25.7 | 48.8 |
|               | 23:30 | 49.4                                                              | 42.6 | 44.2 | 45.4 | 45.7 | 39.3 | 32.5 | 25.1 | 48.5 |
|               | 23:45 | 49.3                                                              | 42.4 | 43.8 | 45.1 | 44.8 | 38.5 | 32.4 | 25.1 | 47.9 |
|               | 00:00 | 48.5                                                              | 42.3 | 43.8 | 45.2 | 44.2 | 38.1 | 32.5 | 25.2 | 47.5 |
|               | 00:15 | 46.9                                                              | 41.9 | 41.2 | 40.7 | 42.4 | 35.9 | 25   | 15.4 | 44.9 |
|               | 00:30 | 46.1                                                              | 41.1 | 40.4 | 40.2 | 42   | 35.5 | 24.5 | 15.1 | 44.4 |
|               | 00:45 | 45.1                                                              | 41.5 | 40.5 | 39.6 | 41.1 | 34.7 | 24.2 | 15   | 43.7 |
|               | 01:00 | 44.6                                                              | 41   | 40.1 | 39.5 | 41.2 | 34.7 | 24.4 | 15   | 43.7 |
|               | 01:15 | 46                                                                | 41.1 | 39.9 | 38.9 | 39.6 | 34.2 | 24.5 | 15.2 | 42.7 |
|               | 01:30 | 43.9                                                              | 40.3 | 39.3 | 38.7 | 39.7 | 33.2 | 23.8 | 14.8 | 42.4 |
|               | 01:45 | 45.6                                                              | 40.5 | 41   | 39.6 | 39.3 | 33   | 23.7 | 14.5 | 42.5 |
|               | 02:00 | 46.4                                                              | 40.4 | 40.3 | 39.2 | 38.8 | 32.7 | 23.8 | 14.7 | 42.1 |
|               | 02:15 | 49.1                                                              | 40.5 | 39.5 | 39.2 | 39.4 | 33   | 23.8 | 14.7 | 42.4 |
|               | 02:30 | 47.8                                                              | 40.2 | 39   | 38.8 | 39.4 | 33.3 | 24.1 | 14.9 | 42.3 |
|               | 02:45 | 42.8                                                              | 39.7 | 38.3 | 37.6 | 37.9 | 32.6 | 23.5 | 14.6 | 41.1 |
|               | 03:00 | 43.3                                                              | 40   | 38.2 | 37.4 | 37.7 | 32.3 | 23.4 | 14.6 | 40.9 |
|               | 03:15 | 53.7                                                              | 39.7 | 37.9 | 37.2 | 36.8 | 31.5 | 23.3 | 14.8 | 40.4 |
| Excluded rain | 03:30 | 48.5                                                              | 41   | 39.3 | 38.7 | 39.9 | 34   | 23.7 | 14.5 | 42.7 |
| Excluded rain | 03:45 | 42.6                                                              | 41   | 39.5 | 39.2 | 39.5 | 35.5 | 27.4 | 17.1 | 43   |
| Excluded rain | 04:00 | 43.8                                                              | 43.3 | 41.2 | 42.5 | 43.1 | 41.3 | 38.6 | 33.9 | 47.7 |
| Excluded rain | 04:15 | 47.7                                                              | 42.9 | 43.1 | 45.6 | 42.9 | 39.6 | 37   | 31.1 | 47.7 |
| Excluded rain | 04:30 | 47.9                                                              | 42.4 | 43.3 | 45.7 | 44.3 | 39.5 | 35.5 | 29.2 | 48.1 |
| Excluded rain | 04:45 | 47.3                                                              | 41.4 | 43.1 | 45.6 | 43.4 | 38.3 | 34.6 | 28.3 | 47.4 |

| Date          | Time  | Measured $L_{90,15min}$ (dB) at each octave band centre frequency |      |      |      |      |      |      |      | dBA  |
|---------------|-------|-------------------------------------------------------------------|------|------|------|------|------|------|------|------|
|               |       | 63                                                                | 125  | 250  | 500  | 1k   | 2k   | 4k   | 8k   |      |
| Excluded rain | 05:00 | 49.2                                                              | 42   | 43.7 | 45.9 | 44.5 | 39.2 | 34.4 | 27.8 | 48.1 |
| Excluded rain | 05:15 | 48.4                                                              | 42   | 42.3 | 42.5 | 44.6 | 38.9 | 30.7 | 22.8 | 47.2 |
| Excluded rain | 05:30 | 48.3                                                              | 43.2 | 43.9 | 44.9 | 48.6 | 42.3 | 31.5 | 20.8 | 50.6 |
|               | 05:45 | 49.5                                                              | 44.2 | 45   | 46   | 50.2 | 43.9 | 32.1 | 19.5 | 52.1 |
|               | 06:00 | 50.6                                                              | 44.7 | 44.7 | 45   | 49.1 | 43.2 | 31.1 | 18.8 | 51.2 |
|               | 06:15 | 50.6                                                              | 45.5 | 47.1 | 48.1 | 52.6 | 46.2 | 33.4 | 19.6 | 54.5 |
|               | 06:30 | 52.6                                                              | 46.6 | 47.9 | 48.7 | 53.2 | 46.9 | 34.1 | 19.8 | 55.1 |
|               | 06:45 | 53.5                                                              | 47.3 | 48.4 | 49.1 | 53.5 | 47.3 | 34.4 | 19.4 | 55.4 |

**Table A-6 – Arithmetic average measured  $L_{90,15mins}$  levels during night-time (23:00-07:00) L1**

|  | Time  | Arithmetic average of $L_{90,15min}$ (dB) at each octave band centre frequency |      |      |      |      |      |      |      | dBA  |
|--|-------|--------------------------------------------------------------------------------|------|------|------|------|------|------|------|------|
|  |       | 63                                                                             | 125  | 250  | 500  | 1k   | 2k   | 4k   | 8k   |      |
|  | 00:00 | 53.6                                                                           | 45.4 | 46.3 | 46.8 | 48.8 | 42.2 | 32.7 | 24.0 | 51.1 |
|  | 00:15 | 53.1                                                                           | 44.9 | 45.8 | 46.4 | 48.1 | 41.4 | 32.1 | 23.4 | 50.5 |
|  | 00:30 | 53.0                                                                           | 44.5 | 45.4 | 45.9 | 47.7 | 40.7 | 31.1 | 22.4 | 50.0 |
|  | 00:45 | 52.8                                                                           | 44.4 | 45.1 | 45.5 | 47.0 | 40.5 | 31.2 | 22.4 | 49.5 |
|  | 01:00 | 51.4                                                                           | 44.1 | 44.9 | 45.5 | 47.4 | 41.2 | 32.2 | 23.8 | 49.8 |
|  | 01:15 | 51.4                                                                           | 43.8 | 43.6 | 43.4 | 46.1 | 40.4 | 29.8 | 20.4 | 48.5 |
|  | 01:30 | 51.2                                                                           | 44.1 | 43.8 | 43.4 | 46.2 | 39.8 | 29.3 | 20.4 | 48.5 |
|  | 01:45 | 51.5                                                                           | 43.7 | 43.5 | 42.9 | 45.4 | 38.8 | 28.8 | 20.2 | 47.7 |
|  | 02:00 | 49.8                                                                           | 43.2 | 43.1 | 42.5 | 45.0 | 38.5 | 28.7 | 20.0 | 47.3 |
|  | 02:15 | 50.0                                                                           | 43.1 | 42.6 | 42.1 | 44.2 | 38.2 | 28.8 | 20.3 | 46.7 |
|  | 02:30 | 49.3                                                                           | 42.7 | 42.1 | 41.8 | 44.0 | 37.5 | 28.2 | 19.8 | 46.4 |
|  | 02:45 | 50.5                                                                           | 43.0 | 43.3 | 43.2 | 44.1 | 37.8 | 29.1 | 20.6 | 46.9 |
|  | 03:00 | 50.5                                                                           | 42.9 | 43.2 | 43.3 | 44.4 | 38.0 | 29.2 | 20.6 | 47.0 |
|  | 03:15 | 52.0                                                                           | 42.8 | 42.4 | 42.7 | 43.5 | 37.3 | 28.7 | 20.2 | 46.3 |
|  | 03:30 | 52.9                                                                           | 42.7 | 42.2 | 42.7 | 43.6 | 38.4 | 29.9 | 20.4 | 46.6 |
|  | 03:45 | 48.4                                                                           | 42.2 | 41.2 | 40.8 | 42.5 | 36.6 | 27.6 | 18.9 | 45.1 |

|  |         | Arithmetic average of $L_{90,15\text{min}}$ (dB) at each octave band centre frequency |      |      |      |      |      |      |      |      |
|--|---------|---------------------------------------------------------------------------------------|------|------|------|------|------|------|------|------|
|  | Time    | 63                                                                                    | 125  | 250  | 500  | 1k   | 2k   | 4k   | 8k   | dBA  |
|  | 04:00   | 48.4                                                                                  | 42.1 | 41.8 | 42.2 | 42.8 | 37.0 | 29.5 | 21.5 | 45.7 |
|  | 04:15   | 51.7                                                                                  | 42.2 | 41.5 | 41.7 | 42.4 | 36.6 | 29.1 | 21.1 | 45.4 |
|  | 04:30   | 51.2                                                                                  | 43.5 | 43.4 | 44.3 | 45.3 | 39.2 | 31.7 | 24.0 | 48.0 |
|  | 04:45   | 51.0                                                                                  | 43.5 | 43.0 | 43.4 | 44.2 | 38.1 | 31.3 | 23.6 | 47.0 |
|  | 05:00   | 50.8                                                                                  | 43.6 | 42.4 | 42.8 | 43.7 | 37.6 | 29.5 | 21.2 | 46.4 |
|  | 05:15   | 51.1                                                                                  | 43.7 | 42.2 | 42.0 | 44.1 | 37.9 | 28.7 | 20.2 | 46.6 |
|  | 05:30   | 51.3                                                                                  | 43.4 | 42.1 | 41.6 | 43.4 | 37.2 | 28.5 | 20.2 | 45.9 |
|  | 05:45   | 51.4                                                                                  | 43.4 | 42.1 | 41.5 | 43.1 | 36.9 | 28.4 | 20.2 | 45.7 |
|  | 06:00   | 51.2                                                                                  | 43.5 | 42.4 | 41.5 | 43.1 | 36.8 | 28.6 | 20.3 | 45.7 |
|  | 06:15   | 51.1                                                                                  | 43.5 | 42.6 | 42.0 | 44.1 | 37.7 | 28.7 | 20.1 | 46.6 |
|  | 06:30   | 51.9                                                                                  | 44.1 | 43.6 | 43.6 | 46.8 | 40.3 | 29.5 | 20.4 | 48.9 |
|  | 06:45   | 51.8                                                                                  | 44.1 | 44.4 | 44.5 | 48.0 | 41.5 | 30.5 | 20.1 | 50.1 |
|  | Minimum | 48.4                                                                                  | 42.1 | 41.2 | 40.8 | 42.4 | 36.6 | 27.6 | 18.9 | 45.1 |

**Table A-7 – Position L2, measured  $L_{90,15\text{ min}}$  levels during night-time (23:00-07:00)**

|          |       | Measured $L_{90,15\text{min}}$ (dB) at each octave band centre frequency |      |      |      |      |      |      |      |      |
|----------|-------|--------------------------------------------------------------------------|------|------|------|------|------|------|------|------|
| Date     | Time  | 63                                                                       | 125  | 250  | 500  | 1k   | 2k   | 4k   | 8k   | dBA  |
| 17/08/19 | 00:00 | 54.4                                                                     | 51.3 | 50.9 | 50.3 | 53.5 | 46.7 | 35.2 | 22.7 | 55.6 |
|          | 00:15 | 54.4                                                                     | 51.2 | 50.3 | 49.2 | 52   | 46.2 | 35   | 22.5 | 54.4 |
|          | 00:30 | 54.6                                                                     | 51.6 | 50.4 | 49.5 | 52.3 | 45.5 | 34.5 | 23   | 54.5 |
|          | 00:45 | 55.4                                                                     | 51.6 | 50.5 | 49.4 | 51.9 | 45.3 | 34.5 | 22.8 | 54.2 |
|          | 01:00 | 53.4                                                                     | 51.3 | 50.3 | 49   | 51.5 | 44.9 | 34.2 | 22.5 | 53.8 |
|          | 01:15 | 53.7                                                                     | 51.3 | 50   | 48.9 | 51.4 | 44.6 | 34.1 | 22.6 | 53.7 |
|          | 01:30 | 53.5                                                                     | 51.4 | 50   | 48.8 | 51.1 | 44.5 | 34.2 | 22.2 | 53.5 |
|          | 01:45 | 54.1                                                                     | 54.9 | 52.3 | 53.2 | 51.9 | 45.5 | 38.4 | 30.9 | 55.3 |
|          | 02:00 | 54.6                                                                     | 55.1 | 52.1 | 53   | 52.4 | 45.6 | 38.3 | 30.5 | 55.5 |
|          | 02:15 | 55.8                                                                     | 54.8 | 51.8 | 52.2 | 51.1 | 44.7 | 37.7 | 29.9 | 54.5 |
|          | 02:30 | 63.8                                                                     | 55.3 | 52.6 | 53.7 | 52.4 | 45.4 | 37.9 | 29.9 | 55.8 |
|          | 02:45 | 54.3                                                                     | 51.6 | 49.6 | 48.3 | 50.3 | 43.6 | 34.2 | 23.7 | 52.8 |
|          | 03:00 | 51.3                                                                     | 51   | 48.9 | 47.5 | 49.5 | 42.8 | 32.6 | 21.3 | 52.0 |
|          | 03:15 | 51.3                                                                     | 51.1 | 48.8 | 47.2 | 48.5 | 42   | 32.4 | 21.1 | 51.2 |
|          | 03:30 | 51.7                                                                     | 51.1 | 48.9 | 47.4 | 48.6 | 42   | 32.2 | 20.7 | 51.3 |
|          | 03:45 | 51.2                                                                     | 51.2 | 48.7 | 47.2 | 48.3 | 41.7 | 32.2 | 20.9 | 51.1 |
|          | 04:00 | 51.3                                                                     | 51.1 | 48.9 | 47.9 | 49   | 41.9 | 32   | 20.5 | 51.6 |
|          | 04:15 | 52                                                                       | 51.1 | 49.1 | 48.5 | 49.6 | 42.8 | 32.4 | 21   | 52.2 |
|          | 04:30 | 52.6                                                                     | 50.4 | 49.1 | 48.3 | 49.5 | 42.6 | 32.6 | 21.7 | 52.1 |
|          | 04:45 | 52.7                                                                     | 50.7 | 49   | 47.7 | 48.8 | 41.8 | 32.1 | 20.9 | 51.5 |
|          | 05:00 | 52.3                                                                     | 50.8 | 48.8 | 47.3 | 48   | 41.3 | 31.9 | 20.9 | 50.9 |
|          | 05:15 | 52.4                                                                     | 51   | 49.1 | 47.9 | 49.5 | 42.5 | 32.8 | 21.8 | 52.0 |
|          | 05:30 | 52.9                                                                     | 51.2 | 49.7 | 48.9 | 51.8 | 44.7 | 32.8 | 21.1 | 53.9 |
|          | 05:45 | 54.2                                                                     | 50.9 | 50.4 | 49.6 | 52.7 | 45.6 | 33.9 | 21.8 | 54.8 |
|          | 06:00 | 55.5                                                                     | 51.2 | 50.5 | 49.4 | 51.2 | 44.3 | 33.5 | 22.1 | 53.6 |
|          | 06:15 | 54.2                                                                     | 50.8 | 50.5 | 50   | 53.2 | 46.1 | 34   | 21.6 | 55.2 |
|          | 06:30 | 56.3                                                                     | 52.2 | 52.7 | 52.9 | 55.7 | 49   | 38.1 | 24.4 | 57.8 |
|          | 06:45 | 56.9                                                                     | 56.2 | 53.7 | 54.8 | 55.3 | 48.8 | 41.3 | 32.3 | 58.1 |

| Date     | Time  | Measured $L_{90,15min}$ (dB) at each octave band centre frequency |      |      |      |      |      |      |      | dBA  |
|----------|-------|-------------------------------------------------------------------|------|------|------|------|------|------|------|------|
|          |       | 63                                                                | 125  | 250  | 500  | 1k   | 2k   | 4k   | 8k   |      |
| 18/08/19 | 23:00 | 55.6                                                              | 53.3 | 51.9 | 51.6 | 54.8 | 47.4 | 35.5 | 23.9 | 56.8 |
|          | 23:15 | 55                                                                | 52.8 | 52.3 | 51.9 | 54.9 | 47.3 | 34.4 | 21.8 | 56.9 |
|          | 23:30 | 55.3                                                              | 52.7 | 51.3 | 50.7 | 53.8 | 46.1 | 33.1 | 21   | 55.8 |
|          | 23:45 | 55.1                                                              | 52.4 | 51.3 | 50.7 | 53.6 | 46.3 | 33.8 | 21.3 | 55.7 |
|          | 00:00 | 55.1                                                              | 52.6 | 51.1 | 50.4 | 53.2 | 45.7 | 33.6 | 21.5 | 55.3 |
|          | 00:15 | 54.9                                                              | 52.5 | 50.3 | 49.7 | 52.5 | 44.7 | 32   | 19.9 | 54.5 |
|          | 00:30 | 54.9                                                              | 52.4 | 50.3 | 49.4 | 51.9 | 44.3 | 32.3 | 20.9 | 54.0 |
|          | 00:45 | 54.1                                                              | 52.2 | 50   | 49.1 | 51.9 | 44   | 31.2 | 19.2 | 53.9 |
|          | 01:00 | 53.1                                                              | 51.9 | 49.8 | 48.8 | 51.1 | 43.3 | 30.5 | 17.4 | 53.3 |
|          | 01:15 | 53.5                                                              | 52.1 | 49.8 | 49.1 | 51.4 | 43.9 | 32.1 | 21.5 | 53.6 |
|          | 01:30 | 52.4                                                              | 51.7 | 49.4 | 48.4 | 50.9 | 42.9 | 30.3 | 17.7 | 53.0 |
|          | 01:45 | 52.4                                                              | 51.8 | 49   | 47.8 | 50.3 | 42.6 | 30.7 | 19.1 | 52.5 |
|          | 02:00 | 52.5                                                              | 52.1 | 49.8 | 49.1 | 52   | 44.3 | 31.8 | 19.3 | 54.0 |
|          | 02:15 | 51.1                                                              | 51.3 | 48.4 | 47.2 | 49.2 | 41.8 | 29.7 | 17.6 | 51.5 |
|          | 02:30 | 51.7                                                              | 51.3 | 48.9 | 47.8 | 49.7 | 43.1 | 31.5 | 19.3 | 52.2 |
|          | 02:45 | 51.2                                                              | 50.8 | 48.3 | 47   | 48.6 | 41.2 | 29.7 | 18.5 | 51.1 |
|          | 03:00 | 53.2                                                              | 54.4 | 51.8 | 53.5 | 51.2 | 44.1 | 37.7 | 32   | 54.9 |
|          | 03:15 | 53                                                                | 54.3 | 51.1 | 52.6 | 51.7 | 44.5 | 37   | 31   | 54.8 |
|          | 03:30 | 53.1                                                              | 54.2 | 50.9 | 52.1 | 51.2 | 44.3 | 36.5 | 30.6 | 54.4 |
|          | 03:45 | 52.7                                                              | 53.9 | 50.6 | 51.6 | 50.1 | 43.1 | 36.2 | 30.2 | 53.5 |
|          | 04:00 | 51.7                                                              | 51   | 49.4 | 48.8 | 49.8 | 42.7 | 33.2 | 24   | 52.4 |
|          | 04:15 | 50.7                                                              | 50.2 | 47.6 | 46.5 | 48.3 | 41.2 | 29.6 | 18.2 | 50.7 |
|          | 04:30 | 50.9                                                              | 50.1 | 47.2 | 45.9 | 47.4 | 40.1 | 28.8 | 17.1 | 49.9 |
|          | 04:45 | 50.3                                                              | 50   | 47.1 | 45.7 | 46.8 | 39.5 | 29   | 18.7 | 49.5 |
|          | 05:00 | 50                                                                | 50.1 | 47   | 45.6 | 46.7 | 39.6 | 28.6 | 17.1 | 49.4 |
|          | 05:15 | 50.5                                                              | 50.3 | 47.4 | 45.8 | 47.4 | 40.1 | 29.2 | 18.1 | 49.9 |
|          | 05:30 | 50.4                                                              | 50.6 | 47.9 | 46.8 | 49.5 | 42.2 | 30.1 | 18.7 | 51.7 |
|          | 05:45 | 51.2                                                              | 50.6 | 48.2 | 47.4 | 49.9 | 42.5 | 30.6 | 18.9 | 52.1 |

| Date          | Time  | Measured $L_{90,15min}$ (dB) at each octave band centre frequency |      |      |      |      |      |      |      | dBA  |
|---------------|-------|-------------------------------------------------------------------|------|------|------|------|------|------|------|------|
|               |       | 63                                                                | 125  | 250  | 500  | 1k   | 2k   | 4k   | 8k   |      |
|               | 06:00 | 50.4                                                              | 50   | 47.9 | 46.5 | 48.8 | 41.2 | 29.5 | 17.9 | 51   |
|               | 06:15 | 52.2                                                              | 50.8 | 48.4 | 46.9 | 48.8 | 41.5 | 29.9 | 18.6 | 51.2 |
|               | 06:30 | 53.8                                                              | 51.5 | 49.5 | 48.2 | 50.7 | 42.9 | 30.6 | 18.2 | 52.8 |
|               | 06:45 | 52.9                                                              | 50.5 | 47.9 | 46.6 | 48   | 40.9 | 30.7 | 18.7 | 50.6 |
| 19/08/19      | 23:00 | 54.4                                                              | 52.5 | 50.9 | 52.5 | 51.8 | 44.7 | 36.8 | 30.5 | 54.8 |
|               | 23:15 | 53.8                                                              | 52.3 | 50.6 | 52.3 | 50.5 | 43.7 | 36.7 | 30.6 | 54   |
|               | 23:30 | 53.6                                                              | 52.1 | 50.4 | 51.9 | 51   | 43.9 | 36.3 | 30   | 54.1 |
|               | 23:45 | 53.6                                                              | 52.1 | 50   | 51.7 | 50   | 43.2 | 36.2 | 29.9 | 53.5 |
|               | 00:00 | 52.4                                                              | 52.3 | 50   | 51.8 | 49.3 | 42.5 | 36.2 | 30   | 53.1 |
|               | 00:15 | 51.9                                                              | 50.4 | 47.9 | 46.5 | 47.8 | 40.6 | 29.3 | 16.7 | 50.4 |
|               | 00:30 | 50.6                                                              | 50.3 | 47.4 | 45.6 | 46.7 | 39.5 | 28.4 | 16.6 | 49.4 |
|               | 00:45 | 50.5                                                              | 50.1 | 47   | 45.1 | 46.4 | 39.4 | 28.4 | 16.4 | 49.1 |
|               | 01:00 | 49.7                                                              | 49.9 | 46.9 | 45   | 45.9 | 38.7 | 28.3 | 16.3 | 48.7 |
|               | 01:15 | 50.5                                                              | 50   | 46.8 | 44.4 | 44.2 | 37.9 | 28.2 | 17.3 | 47.6 |
|               | 01:30 | 48.5                                                              | 49.5 | 46.6 | 44.5 | 44.7 | 37.6 | 28.2 | 16.5 | 47.8 |
|               | 01:45 | 49.1                                                              | 49.3 | 46.1 | 44   | 43.9 | 37.1 | 27.6 | 15.9 | 47.2 |
|               | 02:00 | 49.1                                                              | 49.1 | 46   | 44.1 | 43.5 | 36.8 | 27.4 | 16   | 46.9 |
|               | 02:15 | 56.6                                                              | 49.9 | 49.7 | 49.4 | 48.2 | 39.5 | 28.8 | 16   | 51.4 |
|               | 02:30 | 50.7                                                              | 49.7 | 46.5 | 45.1 | 45.2 | 38.3 | 28.2 | 16.3 | 48.3 |
|               | 02:45 | 47.7                                                              | 49.1 | 45.5 | 43.4 | 43   | 36.7 | 27.2 | 15.4 | 46.5 |
|               | 03:00 | 48.3                                                              | 49   | 45.7 | 43.4 | 43.1 | 36.4 | 26.9 | 15.5 | 46.5 |
|               | 03:15 | 57.5                                                              | 49.2 | 45.4 | 43.2 | 42.1 | 35.9 | 27   | 16   | 46   |
| Excluded rain | 03:30 | 49.9                                                              | 49.7 | 46.3 | 44.2 | 44.8 | 37.7 | 27.2 | 15.8 | 47.8 |
| Excluded rain | 03:45 | 47.5                                                              | 49.4 | 46.2 | 44.6 | 44.2 | 39.1 | 31.6 | 21.5 | 47.8 |
| Excluded rain | 04:00 | 48.4                                                              | 50.9 | 47.2 | 47.3 | 48.5 | 44.3 | 39.2 | 32.8 | 51.8 |
| Excluded rain | 04:15 | 51.6                                                              | 51.5 | 50.2 | 51.5 | 48.6 | 42.8 | 37.6 | 31.2 | 52.8 |
| Excluded rain | 04:30 | 51.9                                                              | 51.7 | 50.2 | 51.6 | 49.8 | 43.3 | 36.8 | 30.3 | 53.4 |
| Excluded rain | 04:45 | 51.9                                                              | 51.2 | 49.8 | 51.5 | 49.2 | 42.7 | 36.5 | 30.5 | 53.0 |

| Date          | Time  | Measured $L_{90,15\text{min}}$ (dB) at each octave band centre frequency |      |      |      |      |      |      |      | dBA  |
|---------------|-------|--------------------------------------------------------------------------|------|------|------|------|------|------|------|------|
|               |       | 63                                                                       | 125  | 250  | 500  | 1k   | 2k   | 4k   | 8k   |      |
| Excluded rain | 05:00 | 52.3                                                                     | 50.8 | 50.3 | 51.6 | 49.4 | 42.9 | 36.7 | 30.7 | 53.1 |
| Excluded rain | 05:15 | 51.4                                                                     | 50.4 | 48.4 | 47.8 | 49.6 | 42.7 | 32.2 | 19.4 | 52.0 |
| Excluded rain | 05:30 | 51.7                                                                     | 50.8 | 49.3 | 49.2 | 52.8 | 46   | 34   | 19.6 | 54.8 |
|               | 05:45 | 53.1                                                                     | 51.1 | 50.2 | 50.6 | 55   | 48   | 35.3 | 20.9 | 56.8 |
|               | 06:00 | 53.9                                                                     | 51.6 | 50.6 | 50.7 | 54.5 | 47.8 | 35.4 | 20.5 | 56.5 |
|               | 06:15 | 54.6                                                                     | 52.1 | 52.7 | 53.2 | 57.7 | 50.9 | 38.3 | 22.3 | 59.5 |
|               | 06:30 | 56.1                                                                     | 53.3 | 54.2 | 54.2 | 58.6 | 51.8 | 39.3 | 23.9 | 60.4 |
|               | 06:45 | 56.5                                                                     | 53.7 | 54.6 | 54.7 | 59.2 | 52.5 | 39.5 | 23.7 | 61.0 |

**Table A-8 – Arithmetic average measured  $L_{90,15\text{mins}}$  levels during night-time (23:00-07:00) L2**

|  | Time  | Arithmetic average of $L_{90,15\text{min}}$ (dB) at each octave band centre frequency |      |      |      |      |      |      |      | dBA  |
|--|-------|---------------------------------------------------------------------------------------|------|------|------|------|------|------|------|------|
|  |       | 63                                                                                    | 125  | 250  | 500  | 1k   | 2k   | 4k   | 8k   |      |
|  | 00:00 | 55.0                                                                                  | 52.9 | 51.4 | 52.1 | 53.3 | 46.1 | 36.2 | 27.2 | 55.7 |
|  | 00:15 | 54.4                                                                                  | 52.6 | 51.5 | 52.1 | 52.7 | 45.5 | 35.6 | 26.2 | 55.3 |
|  | 00:30 | 54.5                                                                                  | 52.4 | 50.9 | 51.3 | 52.4 | 45.0 | 34.7 | 25.5 | 54.8 |
|  | 00:45 | 54.4                                                                                  | 52.3 | 50.7 | 51.2 | 51.8 | 44.8 | 35.0 | 25.6 | 54.4 |
|  | 01:00 | 54.0                                                                                  | 52.1 | 50.7 | 50.8 | 52.0 | 45.0 | 35.0 | 24.7 | 54.5 |
|  | 01:15 | 53.7                                                                                  | 51.4 | 49.5 | 48.5 | 50.8 | 43.8 | 32.1 | 19.7 | 53.1 |
|  | 01:30 | 53.4                                                                                  | 51.4 | 49.4 | 48.2 | 50.3 | 43.1 | 31.7 | 20.2 | 52.6 |
|  | 01:45 | 53.3                                                                                  | 51.3 | 49.2 | 47.9 | 50.1 | 42.9 | 31.4 | 19.5 | 52.4 |
|  | 02:00 | 52.1                                                                                  | 51.0 | 49.0 | 47.6 | 49.5 | 42.3 | 31.0 | 18.7 | 51.9 |
|  | 02:15 | 52.6                                                                                  | 51.1 | 48.9 | 47.5 | 49.0 | 42.1 | 31.5 | 20.5 | 51.6 |
|  | 02:30 | 51.5                                                                                  | 50.9 | 48.7 | 47.2 | 48.9 | 41.7 | 30.9 | 18.8 | 51.4 |
|  | 02:45 | 51.9                                                                                  | 52.0 | 49.1 | 48.3 | 48.7 | 41.7 | 32.2 | 22.0 | 51.6 |
|  | 03:00 | 52.1                                                                                  | 52.1 | 49.3 | 48.7 | 49.3 | 42.2 | 32.5 | 21.9 | 52.1 |
|  | 03:15 | 54.5                                                                                  | 52.0 | 50.0 | 49.6 | 49.5 | 42.0 | 32.1 | 21.2 | 52.4 |
|  | 03:30 | 55.4                                                                                  | 52.1 | 49.3 | 48.9 | 49.1 | 42.3 | 32.5 | 21.8 | 52.0 |
|  | 03:45 | 51.1                                                                                  | 50.5 | 47.8 | 46.2 | 47.3 | 40.5 | 30.4 | 19.2 | 50.1 |

|  | Time    | Arithmetic average of $L_{90,15\text{min}}$ (dB) at each octave band centre frequency |      |      |      |      |      |      |      | dBA  |
|--|---------|---------------------------------------------------------------------------------------|------|------|------|------|------|------|------|------|
|  |         | 63                                                                                    | 125  | 250  | 500  | 1k   | 2k   | 4k   | 8k   |      |
|  | 04:00   | 50.9                                                                                  | 51.5 | 48.8 | 48.1 | 47.9 | 41.1 | 32.4 | 22.9 | 51.0 |
|  | 04:15   | 53.9                                                                                  | 51.5 | 48.4 | 47.7 | 47.4 | 40.8 | 32.1 | 22.7 | 50.6 |
|  | 04:30   | 52.4                                                                                  | 52.7 | 49.9 | 49.8 | 49.9 | 43.2 | 34.4 | 25.7 | 52.8 |
|  | 04:45   | 52.0                                                                                  | 52.6 | 49.7 | 49.4 | 49.2 | 42.4 | 34.2 | 25.6 | 52.3 |
|  | 05:00   | 51.5                                                                                  | 51.1 | 49.2 | 48.4 | 49.4 | 42.3 | 32.6 | 22.3 | 52.0 |
|  | 05:15   | 51.4                                                                                  | 50.7 | 48.4 | 47.5 | 49.0 | 42.0 | 31.0 | 19.6 | 51.5 |
|  | 05:30   | 51.8                                                                                  | 50.3 | 48.2 | 47.1 | 48.5 | 41.4 | 30.7 | 19.4 | 51.0 |
|  | 05:45   | 51.5                                                                                  | 50.4 | 48.1 | 46.7 | 47.8 | 40.7 | 30.6 | 19.8 | 50.5 |
|  | 06:00   | 51.2                                                                                  | 50.5 | 47.9 | 46.5 | 47.4 | 40.5 | 30.3 | 19.0 | 50.1 |
|  | 06:15   | 51.5                                                                                  | 50.7 | 48.3 | 46.9 | 48.5 | 41.3 | 31.0 | 20.0 | 51.0 |
|  | 06:30   | 51.7                                                                                  | 50.9 | 48.8 | 47.9 | 50.7 | 43.5 | 31.5 | 19.9 | 52.8 |
|  | 06:45   | 52.8                                                                                  | 50.9 | 49.6 | 49.2 | 52.5 | 45.4 | 33.3 | 20.5 | 54.5 |
|  | Minimum | 50.9                                                                                  | 50.3 | 47.8 | 46.2 | 47.3 | 40.5 | 30.3 | 18.7 | 50.1 |

# Appendix B

SUMMARY OF EQUIPMENT USED FOR  
NOISE SURVEYS



**Table B-1 – Summary of noise monitoring equipment**

| Position | Equipment         | Make/Model                   | Serial No. | Calibration due |
|----------|-------------------|------------------------------|------------|-----------------|
| L1       | Sound Level Meter | 01 dB CUBE                   | 10629      | 07/03/20        |
|          | Pre-amplifier     | Acoem PRE 22                 | 10563      | 07/03/20        |
|          | Microphone        | GRAS 40CD                    | 161937     | 07/03/20        |
|          | Calibrator        | 01 dB-Metravib CAL 21        | 34344462   | 27/09/19        |
| L2       | Sound Level Meter | 01 dB CUBE                   | 10621      | 14/05/21        |
|          | Pre-amplifier     | Acoem PRE 22                 | 10635      | 14/05/21        |
|          | Microphone        | GRAS 40CD                    | 207269     | 14/05/21        |
|          | Calibrator        | 01 dB-Metravib CAL 21        | 34344463   | 24/9/19         |
| P1-P5    | Sound Level Meter | 01 dB-Metravib Solo Master   | 65804      | 05/12/19        |
|          | Pre-amplifier     | 01 dB-Stell PRE 21 S         | 16471      | 05/12/19        |
|          | Microphone        | Microtech Gefell GmbH MCE212 | 175391     | 05/12/19        |
|          | Calibrator        | 01 dB-Metravib Cal 21        | 35113823   | 12/12/19        |

# Appendix C

## GLOSSARY OF TERMS





## NOISE

Noise is defined as unwanted sound. Human ears are able to respond to sound in the frequency range 20 Hz (deep bass) to 20,000 Hz (high treble) and over the audible range of 0 dB (the threshold of perception) to 140 dB (the threshold of pain). The ear does not respond equally to different frequencies of the same magnitude, but is more responsive to mid-frequencies than to lower or higher frequencies. To quantify noise in a manner that approximates the response of the human ear, a weighting mechanism is used. This reduces the importance of lower and higher frequencies, in a similar manner to the human ear.

Furthermore, the perception of noise may be determined by a number of other factors, which may not necessarily be acoustic. In general, the impact of noise depends upon its level, the margin by which it exceeds the background level, its character and its variation over a given period of time. In some cases, the time of day and other acoustic features such as tonality or impulsiveness may be important, as may the disposition of the affected individual. Any assessment of noise should give due consideration to all of these factors when assessing the significance of a noise source.

The most widely used weighting mechanism that best corresponds to the response of the human ear is the 'A'-weighting scale. This is widely used for environmental noise measurement, and the levels are denoted as dB(A) or  $L_{Aeq}$ ,  $L_{A90}$  etc, according to the parameter being measured.

The decibel scale is logarithmic rather than linear, and hence a 3 dB increase in sound level represents a doubling of the sound energy present. Judgement of sound is subjective, but as a general guide a 10 dB(A) increase can be taken to represent a doubling of loudness, whilst an increase in the order of 3 dB(A) is generally regarded as the minimum difference needed to perceive a change under normal listening conditions.

An indication of the range of sound levels commonly found in the environment is given in the following table.

**Table 2 - Range of sound levels commonly found in the environment**

| Sound levels     | Location                   |
|------------------|----------------------------|
| 0 dB(A)          | Threshold of hearing       |
| 20 to 30 dB(A)   | Quiet bedroom at night     |
| 30 to 40 dB(A)   | Living room during the day |
| 40 to 50 dB(A)   | Typical office             |
| 50 to 60 dB(A)   | Inside a car               |
| 60 to 70 dB(A)   | Typical high street        |
| 70 to 90 dB(A)   | Inside factory             |
| 100 to 110 dB(A) | Burglar alarm at 1m away   |
| 110 to 130 dB(A) | Jet aircraft on take off   |
| 140 dB(A)        | Threshold of pain          |

## ACOUSTIC TERMINOLOGY

### Terminology

dB (decibel)

### Meaning

The scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the root-mean-square pressure of the sound field and a reference pressure ( $2 \times 10^{-5} \text{Pa}$ ).

dB(A)

A-weighted decibel. This is a measure of the overall level of sound across the audible spectrum with a frequency weighting (i.e. 'A' - weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.

$L_{Aeq,T}$

$L_{Aeq}$  is defined as the notional steady sound level which, over a stated period of time (T), would contain the same amount of acoustical energy as the A - weighted fluctuating sound measured over that period.

$L_{Amax}$

$L_{Amax}$  is the maximum A - weighted sound pressure level recorded over the period stated.  $L_{Amax}$  is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the overall  $L_{eq}$  noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.

$L_{10}$  and  $L_{90}$

If a non-steady noise is to be described it is necessary to know both its level and the degree of fluctuation. The  $L_n$  indices are used for this purpose, and the term refers to the level exceeded for n% of the time. Hence  $L_{10}$  is the level exceeded for 10% of the time, and the  $L_{90}$  is the level exceeded for 90% of the time.

Free-field Level

A sound field determined at a point away from reflective surfaces other than the ground with no significant contributions due to sound from other reflective surfaces. Generally as measured outside and away from buildings.

Façade Level

A sound field determined at a distance of 1m in front of a large sound reflecting object such as a building façade.

# Appendix D

## LIMITATIONS OF REPORT





This report has been prepared for the titled project or named part thereof and should not be used in whole or part and relied upon for any other project without the written authorisation of WSP UK Limited. WSP UK Limited accepts no responsibility or liability for the consequences of this document if it is used for a purpose other than that for which it was commissioned. Persons wishing to use or rely upon this report for other purposes must seek written authority to do so from the owner of this report and/ or WSP UK Limited and agree to indemnify WSP UK Limited for any and all loss or damage resulting therefrom. WSP UK Limited accepts no responsibility or liability for this document to any other party other than the person by whom it was commissioned.

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# Appendix 6.4 Traffic Data

## All flows 18 Hour AAWT

| Reference | Location                                               | 2018 Base      |           | 2023 Do Minimum |           | Percentage change |           | dB change      |           |
|-----------|--------------------------------------------------------|----------------|-----------|-----------------|-----------|-------------------|-----------|----------------|-----------|
|           |                                                        | Daily Vehicles | Daily HGV | Daily Vehicles  | Daily HGV | Daily Vehicles    | Daily HGV | Daily Vehicles | Daily HGV |
| 1         | Mancunian Way (East of Hoyle St)                       | 47258          | 1775      | 48884           | 1792      | 1.03              | 1.01      | 0.1            | 0.0       |
| 2         | Mancunian Way (West of Hoyle St)                       | 47258          | 1775      | 48884           | 1792      | 1.03              | 1.01      | 0.1            | 0.0       |
| 3         | Fairfield Street (Between Temperance St and Manc. Way) | 7812           | 44        | 7646            | 33        | 0.98              | 0.76      | -0.1           | -1.2      |
| 4         | Fairfield Street (East of Travis Street)               | 7533           | 41        | 7461            | 33        | 0.99              | 0.80      | 0.0            | -1.0      |
| 5         | Fairfield Street (West of Travis Street)               | 12851          | 188       | 13093           | 198       | 1.02              | 1.05      | 0.1            | 0.2       |
| 6         | Travis Street (South of Fairfield Street)              | 6121           | 133       | 6260            | 146       | 1.02              | 1.10      | 0.1            | 0.4       |
| 7         | Travis Street (North of Fairfield Street)              | 7658           | 60        | 8371            | 53        | 1.09              | 0.88      | 0.4            | -0.5      |
| 8         | London Road (North of Travis Street)                   | 14656          | 69        | 15479           | 61        | 1.06              | 0.88      | 0.2            | -0.5      |
| 9         | London Road (South of Travis Street)                   | 17501          | 80        | 17341           | 65        | 0.99              | 0.81      | 0.0            | -0.9      |
| 10        | Downing Street (South of Manc. Way)                    | 30292          | 1019      | 30850           | 1035      | 1.02              | 1.02      | 0.1            | 0.1       |
| 11        | Mancunian Way (North of Fairfield Street)              | 31483          | 971       | 31968           | 954       | 1.02              | 0.98      | 0.1            | -0.1      |
| 12        | Fairfield Street (East of Mancunian Way)               | 24292          | 747       | 25054           | 769       | 1.03              | 1.03      | 0.1            | 0.1       |
| 13        | Pill Mill Brow (North of Fairfield Street)             | 18181          | 147       | 19039           | 180       | 1.05              | 1.22      | 0.2            | 0.9       |
| 14        | A665 Ring Road (North of Pill Mill Brow)               | 46334          | 1019      | 47456           | 994       | 1.02              | 0.97      | 0.1            | -0.1      |
| 15        | A665 Ring Road (south of Pollard St)                   | 33868          | 669       | 34523           | 604       | 1.02              | 0.90      | 0.1            | -0.4      |
| 16        | Ashton Old Road (east of Fairfield Street)             | 24715          | 767       | 25370           | 777       | 1.03              | 1.01      | 0.1            | 0.1       |
| 17        | Chancellor Lane (south of Fairfield Street)            | 19376          | 96        | 20706           | 128       | 1.07              | 1.33      | 0.3            | 1.2       |
| 18        | London Road (north of Fairfield Street)                | 14105          | 108       | 13383           | 121       | 0.95              | 1.13      | -0.2           | 0.5       |
| 19        | Fairfield Street (west of London Road)                 | 16014          | 224       | 17082           | 244       | 1.07              | 1.09      | 0.3            | 0.4       |
| 20        | Whitworth Street (north of London Road)                | 6746           | 34        | 6657            | 30        | 0.99              | 0.87      | -0.1           | -0.6      |
| 21        | Store Street (east of London Road)                     | 635            | 0         | 422             | 0         | 0.66              |           | -1.8           |           |
| 22        | London Road (north of Store Street)                    | 8126           | 112       | 7578            | 127       | 0.93              | 1.13      | -0.3           | 0.5       |
| 23        | Whitworth Street (east of Sackville St)                | 19079          | 298       | 19872           | 350       | 1.04              | 1.17      | 0.2            | 0.7       |
| 24        | Aytoun Street (north of Fairfield Street)              | 8973           | 112       | 8669            | 142       | 0.97              | 1.26      | -0.2           | 1.0       |
| 25        | Auburn Street (west of London Road)                    | 6856           | 94        | 6593            | 123       | 0.96              | 1.31      | -0.2           | 1.2       |
| 26        | Ducie Street (east of London Road)                     | 4114           | 9         | 3752            | 7         | 0.91              | 0.81      | -0.4           | -0.9      |
| 27        | Piccadilly (north of Ducie Street)                     | 8210           | 128       | 8369            | 147       | 1.02              | 1.15      | 0.1            | 0.6       |
| 28        | Portland Street (west of Piccadilly)                   | 2080           | 18        | 1948            | 19        | 0.94              | 1.01      | -0.3           | 0.0       |
| 29        | Newton Street (east of Piccadilly)                     | 5555           | 87        | 5449            | 94        | 0.98              | 1.08      | -0.1           | 0.3       |
| 30        | Store Street (south of Ring Road)                      | 2801           | 5         | 2824            | 2         | 1.01              | 0.50      | 0.0            | -3.0      |
| 31        | Ardwick Green (north of Hyde Road)                     | 26175          | 1026      | 29197           | 1058      | 1.12              | 1.03      | 0.5            | 0.1       |
| 32        | Devonshire Street (north of Hyde Road)                 | 15299          | 62        | 15836           | 82        | 1.04              | 1.32      | 0.1            | 1.2       |
| 33        | Hyde Road (east of Ardwick Green)                      | 18372          | 671       | 19399           | 680       | 1.06              | 1.01      | 0.2            | 0.1       |
| 34        | Hyde Road (east of Devonshire Street N)                | 25837          | 715       | 27120           | 744       | 1.05              | 1.04      | 0.2            | 0.2       |
| 35        | Stockport Road (South of Ardwick Green)                | 16119          | 405       | 17523           | 427       | 1.09              | 1.05      | 0.4            | 0.2       |
| 36        | Pollard Street (north of Ring Road)                    | 5529           | 119       | 5537            | 105       | 1.00              | 0.88      | 0.0            | -0.5      |
| 37        | A665 Ring Road (north of Pollard Street)               | 41299          | 598       | 40965           | 533       | 0.99              | 0.89      | 0.0            | -0.5      |
| 38        | A665 Ring Road (north of Old Mill Street)              | 39293          | 547       | 38726           | 498       | 0.99              | 0.91      | -0.1           | -0.4      |
| 39        | Old Mill Street (north of Store Street)                | 10706          | 367       | 10410           | 368       | 0.97              | 1.00      | -0.1           | 0.0       |
| 40        | Manunian Way (west of London Road)                     | 44829          | 1510      | 46561           | 1511      | 1.04              | 1.00      | 0.2            | 0.0       |
| 41        | Princess Street (north of Mancunian Way)               | 10983          | 243       | 11056           | 291       | 1.01              | 1.20      | 0.0            | 0.8       |
| 42        | Upper Brook Street (south of Mancunian Way)            | 29638          | 637       | 30665           | 667       | 1.03              | 1.05      | 0.1            | 0.2       |
| 43        | Upper Brook Street (south of Plymouth Grove)           | 32767          | 882       | 33285           | 884       | 1.02              | 1.00      | 0.1            | 0.0       |
| 44        | Plymouth Grove (south of Upper Brock Grove)            | 11466          | 192       | 11367           | 232       | 0.99              | 1.21      | 0.0            | 0.8       |
| 45        | Princess Street (north of Whitworth Street)            | 3384           | 0         | 3846            | 0         | 1.14              |           | 0.6            |           |
| 46        | Portland Street (east Princess Street)                 | 11281          | 57        | 12308           | 68        | 1.09              | 1.19      | 0.4            | 0.8       |
| 47        | Mancunian Way (west of Brook Street)                   | 86037          | 2776      | 88696           | 2788      | 1.03              | 1.00      | 0.1            | 0.0       |
| 48        | Oxford Road (north of Mancunian Way)                   | 5846           | 9         | 6203            | 2         | 1.06              | 0.25      | 0.3            | -6.0      |
| 49        | Oxford Road (south of Mancunian Way)                   | 3010           | 0         | 3153            | 0         | 1.05              |           | 0.2            |           |
| 50        | Oxford Road (south of Booth Street E)                  | 2832           | 0         | 2878            | 0         | 1.02              |           | 0.1            |           |
| 51        | Cambridge Street (South of Mancunian Way)              | 21361          | 309       | 22636           | 336       | 1.06              | 1.09      | 0.3            | 0.4       |
| 52        | Cambridge Street (north of Mancunian Way)              | 13313          | 137       | 13600           | 141       | 1.02              | 1.02      | 0.1            | 0.1       |
| 53        | Manunian Way (east of Cambridge Street)                | 56164          | 1677      | 59330           | 1660      | 1.06              | 0.99      | 0.2            | 0.0       |
| 54        | Whitworth Street (west of Oxford Road)                 | 14809          | 330       | 15598           | 333       | 1.05              | 1.01      | 0.2            | 0.0       |
| 55        | Whitworth Street (east of Oxford Road)                 | 14902          | 346       | 15819           | 366       | 1.06              | 1.06      | 0.3            | 0.2       |
| 56        | Oxford Road (north of Whitworth Street)                | 4090           | 21        | 4300            | 36        | 1.05              | 1.75      | 0.2            | 2.4       |
| 57        | Whitworth Street (west of Cambridge Road)              | 13175          | 300       | 13446           | 323       | 1.02              | 1.08      | 0.1            | 0.3       |
| 58        | Medlock Street (north of Mancunian Way)                | 21916          | 394       | 23533           | 375       | 1.07              | 0.95      | 0.3            | -0.2      |
| 59        | Medlock Street (south of Mancunian Way)                | 44261          | 1301      | 46261           | 1312      | 1.05              | 1.01      | 0.2            | 0.0       |
| 60        | Manunian Way (west of Medlock Street)                  | 74048          | 1816      | 78403           | 1823      | 1.06              | 1.00      | 0.2            | 0.0       |
| 61        | Whitworth Street (west of Medlock Street)              | 13410          | 268       | 12800           | 270       | 0.95              | 1.01      | -0.2           | 0.0       |
| 62        | Chester Road (north of Mancunian Way)                  | 19178          | 291       | 22254           | 245       | 1.16              | 0.84      | 0.6            | -0.7      |
| 63        | Chorlton Road (south of Mancunian Way)                 | 9066           | 405       | 8707            | 371       | 0.96              | 0.92      | -0.2           | -0.4      |
| 64        | Chester Road (west of Mancunian Way)                   | 18323          | 1122      | 21685           | 661       | 1.18              | 0.59      | 0.7            | -2.3      |
| 65        | Deansgate (north of Whitworth Street)                  | 18248          | 405       | 20208           | 349       | 1.11              | 0.86      | 0.4            | -0.7      |
| 66        | Great Bridgewater Street (east of Deansgate)           | 6311           | 55        | 6641            | 69        | 1.05              | 1.26      | 0.2            | 1.0       |
| 67        | Great Bridgewater Street (east of Albion Street)       | 4226           | 0         | 4787            | 7         | 1.13              |           | 0.5            |           |
| 68        | Portland Street (east of Oxford Road)                  | 11243          | 76        | 12203           | 79        | 1.09              | 1.05      | 0.4            | 0.2       |
| 69        | Ducie Street (west of Ring Road)                       | 2582           | 0         | 2651            | 0         | 1.03              |           | 0.1            |           |
| 70        | Laystall Street (west of Ring Road)                    | 3154           | 11        | 4163            | 12        | 1.32              | 1.03      | 1.2            | 0.1       |
| 71        | Ring Road (south of Newton Street)                     | 37694          | 561       | 35308           | 498       | 0.94              | 0.89      | -0.3           | -0.5      |
| 72        | Newton Street (west of Ring Road)                      | 6077           | 69        | 5144            | 78        | 0.85              | 1.14      | -0.7           | 0.6       |
| 73        | Ring Road (north of Newton Street)                     | 38455          | 582       | 37002           | 531       | 0.96              | 0.91      | -0.2           | -0.4      |
| 74        | Ring Road (north of Oldham Road)                       | 19254          | 550       | 18756           | 486       | 0.97              | 0.88      | -0.1           | -0.5      |
| 75        | Oldham Road (north of Ring Road)                       | 24048          | 231       | 24174           | 224       | 1.01              | 0.97      | 0.0            | -0.1      |
| 76        | Rochdale Road (north of Ring Road)                     | 14471          | 172       | 14398           | 152       | 0.99              | 0.89      | 0.0            | -0.5      |
| 77        | Ring Road (north of Rochdale Road)                     | 20722          | 486       | 20534           | 447       | 0.99              | 0.92      | 0.0            | -0.4      |
| 78        | Cheetham Hill Road (north of Ring Road)                | 22240          | 763       | 22688           | 758       | 1.02              | 0.99      | 0.1            | 0.0       |
| 79        | Ring Road (west of Cheetham Hill Road)                 | 38427          | 1326      | 38519           | 1298      | 1.00              | 0.98      | 0.0            | -0.1      |
| 80        | Great Ducie Street (north of Ring Road)                | 19034          | 767       | 19475           | 764       | 1.02              | 1.00      | 0.1            | 0.0       |
| 81        | Great Ducie Street (south of Ring Road)                | 18004          | 605       | 18443           | 626       | 1.02              | 1.04      | 0.1            | 0.2       |

# Appendix 6.5 Construction Noise Data Calculations

### Calculation 1

| Description        | No. of Plant | SWL [dB(A)] | Closest Distance [m] | Percentage on time (1.0 = 100%) | ADJUSTMENT (dB(A))     |                         |                         |                          |                        | Resultant Noise Level dB(A) |
|--------------------|--------------|-------------|----------------------|---------------------------------|------------------------|-------------------------|-------------------------|--------------------------|------------------------|-----------------------------|
|                    |              |             |                      |                                 | Distance Correction dB | No. of Plant Correction | Screening Correction dB | Reflection Correction dB | Duration Correction dB |                             |
| Bulldozer          | 2            | 103         | 200                  | 80%                             | -54.0                  | 3.0                     | 0                       | 3                        | -0.97                  | 54.0                        |
| Concrete crusher   | 2            | 110         | 200                  | 80%                             | -54.0                  | 3.0                     | 0                       | 3                        | -0.97                  | 61.0                        |
| Concrete splitter  | 1            | 111         | 200                  | 30%                             | -54.0                  | 0.0                     | 0                       | 3                        | -5.23                  | 54.8                        |
| Concrete saw       | 1            | 119         | 200                  | 30%                             | -54.0                  | 0.0                     | 0                       | 3                        | -5.23                  | 62.8                        |
| Hand held tools    | 5            | 103         | 200                  | 50%                             | -54.0                  | 7.0                     | 0                       | 3                        | -3.01                  | 56.0                        |
| Tracked excavators | 1            | 103         | 200                  | 80%                             | -54.0                  | 0.0                     | 0                       | 3                        | -0.97                  | 51.0                        |
| Breaker            | 1            | 111         | 200                  | 30%                             | -54.0                  | 0.0                     | 0                       | 3                        | -5.23                  | 54.8                        |
| Diesel generators  | 2            | 88          | 200                  | 100%                            | -54.0                  | 3.0                     | 0                       | 3                        | 0.00                   | 40.0                        |
| Access platform    | 2            | 95          | 200                  | 10%                             | -54.0                  | 3.0                     | 0                       | 3                        | -10.00                 | 37.0                        |
| HGV                | 1            | 108         | 200                  | 10%                             | -54.0                  | 0.0                     | 0                       | 3                        | -10.00                 | 47.0                        |
|                    |              |             |                      |                                 |                        |                         |                         |                          |                        |                             |
|                    |              |             |                      |                                 |                        |                         |                         |                          |                        |                             |
|                    |              |             |                      |                                 |                        |                         |                         | Activity Noise Level     |                        | 67                          |

### Calculation 2

| Description                 | No. of Plant | SWL [dB(A)] | Closest Distance [m] | Percentage on time (1.0 = 100%) | ADJUSTMENT (dB(A))     |                         |                         |                          |                        | Resultant Noise Level dB(A) |      |
|-----------------------------|--------------|-------------|----------------------|---------------------------------|------------------------|-------------------------|-------------------------|--------------------------|------------------------|-----------------------------|------|
|                             |              |             |                      |                                 | Distance Correction dB | No. of Plant Correction | Screening Correction dB | Reflection Correction dB | Duration Correction dB |                             |      |
| Atric dump truck            | 2            | 108         | 250                  | 80%                             | -56.0                  | 3.0                     | 0                       | 3                        | -0.97                  | 57.1                        |      |
| Hydraulic tracked excavator | 1            |             | 107                  | 250                             | 80%                    | -56.0                   | 0.0                     | 0                        | 3                      | -0.97                       | 53.1 |
| Tracked loader lorry        | 1            |             | 105                  | 250                             | 80%                    | -56.0                   | 0.0                     | 0                        | 3                      | -0.97                       | 51.1 |
| Generator                   | 1            |             | 88                   | 250                             | 100%                   | -56.0                   | 0.0                     | 0                        | 3                      | 0.00                        | 35.0 |
| HGV                         | 1            |             | 108                  | 250                             | 20%                    | -56.0                   | 0.0                     | 0                        | 3                      | -6.99                       | 48.1 |
|                             |              |             |                      |                                 |                        |                         |                         |                          |                        |                             |      |
|                             |              |             |                      |                                 |                        |                         |                         |                          |                        |                             |      |
| Activity Noise Level        |              |             |                      |                                 |                        |                         |                         | 60                       |                        |                             |      |

### Calculation 3

| Description                 | No. of Plant | SWL [dB(A)] | Closest Distance [m] | Percentage on time (1.0 = 100%) | ADJUSTMENT (dB(A))     |                         |                         |                          |                        | Resultant Noise Level dB(A) |
|-----------------------------|--------------|-------------|----------------------|---------------------------------|------------------------|-------------------------|-------------------------|--------------------------|------------------------|-----------------------------|
|                             |              |             |                      |                                 | Distance Correction dB | No. of Plant Correction | Screening Correction dB | Reflection Correction dB | Duration Correction dB |                             |
| Atric dump truck            | 2            | 108         | 130                  | 80%                             | -50.3                  | 3.0                     | 0                       | 3                        | -0.97                  | 62.8                        |
| Hydraulic tracked excavator | 1            | 107         | 130                  | 80%                             | -50.3                  | 0.0                     | 0                       | 3                        | -0.97                  | 58.8                        |
| Tracked loader lorry        | 1            | 105         | 130                  | 80%                             | -50.3                  | 0.0                     | 0                       | 3                        | -0.97                  | 56.8                        |
| Generator                   | 1            | 88          | 130                  | 100%                            | -50.3                  | 0.0                     | 0                       | 3                        | 0.00                   | 40.7                        |
| HGV                         | 1            | 108         | 130                  | 20%                             | -50.3                  | 0.0                     | 0                       | 3                        | -6.99                  | 53.7                        |
|                             |              |             |                      |                                 |                        |                         |                         |                          |                        |                             |
|                             |              |             |                      |                                 |                        |                         |                         | Activity Noise Level     |                        | 65                          |

### Calculation 4

| Description                 | No. of Plant | SWL [dB(A)] | Closest Distance [m] | Percentage on time (1.0 = 100%) | ADJUSTMENT (dB(A))     |                          |                         |                          |                        | Resultant Noise Level dB(A) |
|-----------------------------|--------------|-------------|----------------------|---------------------------------|------------------------|--------------------------|-------------------------|--------------------------|------------------------|-----------------------------|
|                             |              |             |                      |                                 | Distance Correction dB | No. of Plant Correctio n | Screening Correction dB | Reflection Correction dB | Duration Correction dB |                             |
| Atric dump truck            | 2            | 108         | 100                  | 80%                             | -48.0                  | 3.0                      | 0                       | 3                        | -0.97                  | 65.0                        |
| Hydraulic tracked excavator | 1            | 107         | 100                  | 80%                             | -48.0                  | 0.0                      | 0                       | 3                        | -0.97                  | 61.0                        |
| Tracked loader lorry        | 1            | 105         | 100                  | 80%                             | -48.0                  | 0.0                      | 0                       | 3                        | -0.97                  | 59.0                        |
| Generator                   | 1            | 88          | 100                  | 100%                            | -48.0                  | 0.0                      | 0                       | 3                        | 0.00                   | 43.0                        |
| HGV                         | 1            | 108         | 100                  | 20%                             | -48.0                  | 0.0                      | 0                       | 3                        | -6.99                  | 56.0                        |
|                             |              |             |                      |                                 |                        |                          |                         |                          |                        |                             |
|                             |              |             |                      |                                 |                        |                          |                         |                          |                        |                             |
|                             |              |             |                      |                                 |                        |                          |                         | Activity Noise Level     | 68                     |                             |

### Calculation 5

| Description                 | No. of Plant | SWL [dB(A)] | Closest Distance [m] | Percentage on time (1.0 = 100%) | ADJUSTMENT (dB(A))     |                         |                         |                          |                        | Resultant Noise Level dB(A) |
|-----------------------------|--------------|-------------|----------------------|---------------------------------|------------------------|-------------------------|-------------------------|--------------------------|------------------------|-----------------------------|
|                             |              |             |                      |                                 | Distance Correction dB | No. of Plant Correction | Screening Correction dB | Reflection Correction dB | Duration Correction dB |                             |
| Atric dump truck            | 2            | 108         | 200                  | 80%                             | -54.0                  | 3.0                     | 0                       | 3                        | -0.97                  | 59.0                        |
| Hydraulic tracked excavator | 1            | 107         | 200                  | 80%                             | -54.0                  | 0.0                     | 0                       | 3                        | -0.97                  | 55.0                        |
| Tracked loader lorry        | 1            | 105         | 200                  | 80%                             | -54.0                  | 0.0                     | 0                       | 3                        | -0.97                  | 53.0                        |
| Generator                   | 1            | 88          | 200                  | 100%                            | -54.0                  | 0.0                     | 0                       | 3                        | 0.00                   | 37.0                        |
| HGV                         | 1            | 108         | 200                  | 20%                             | -54.0                  | 0.0                     | 0                       | 3                        | -6.99                  | 50.0                        |
|                             |              |             |                      |                                 |                        |                         |                         |                          |                        |                             |
|                             |              |             |                      |                                 |                        |                         |                         |                          |                        |                             |
|                             |              |             |                      |                                 |                        |                         |                         | Activity Noise Level     | 62                     |                             |

### Calculation 6

| Description | No. of Plant | SWL [dB(A)] | Closest Distance [m] | Percentage on time (1.0 = 100%) | ADJUSTMENT (dB(A))     |                         |                         |                          |                        | Resultant Noise Level dB(A) |
|-------------|--------------|-------------|----------------------|---------------------------------|------------------------|-------------------------|-------------------------|--------------------------|------------------------|-----------------------------|
|             |              |             |                      |                                 | Distance Correction dB | No. of Plant Correction | Screening Correction dB | Reflection Correction dB | Duration Correction dB |                             |
| CFA         | 1            | 105         | 250                  | 50%                             | -56.0                  | 0.0                     | 0                       | 3                        | -3.01                  | 49.0                        |
|             |              |             |                      |                                 |                        |                         |                         |                          |                        |                             |
|             |              |             |                      |                                 |                        |                         |                         | Activity Noise Level     | 49                     |                             |

### Calculation 7

| Description | No. of Plant | SWL [dB(A)] | Closest Distance [m] | Percentage on time (1.0 = 100%) | ADJUSTMENT (dB(A))     |                         |                         |                          |                        | Resultant Noise Level dB(A) |
|-------------|--------------|-------------|----------------------|---------------------------------|------------------------|-------------------------|-------------------------|--------------------------|------------------------|-----------------------------|
|             |              |             |                      |                                 | Distance Correction dB | No. of Plant Correction | Screening Correction dB | Reflection Correction dB | Duration Correction dB |                             |
| CFA         | 1            | 105         | 130                  | 50%                             | -50.3                  | 0.0                     | 0                       | 3                        | -3.01                  | 54.7                        |
|             |              |             |                      |                                 |                        |                         |                         |                          |                        |                             |
|             |              |             |                      |                                 |                        |                         |                         | Activity Noise Level     | 55                     |                             |

### Calculation 8

| Description | No. of Plant | SWL [dB(A)] | Closest Distance [m] | Percentage on time (1.0 = 100%) | ADJUSTMENT (dB(A))     |                         |                         |                          |                        | Resultant Noise Level dB(A) |
|-------------|--------------|-------------|----------------------|---------------------------------|------------------------|-------------------------|-------------------------|--------------------------|------------------------|-----------------------------|
|             |              |             |                      |                                 | Distance Correction dB | No. of Plant Correction | Screening Correction dB | Reflection Correction dB | Duration Correction dB |                             |
| CFA         | 1            | 105         | 100                  | 50%                             | -48.0                  | 0.0                     | 0                       | 3                        | -3.01                  | 57.0                        |
|             |              |             |                      |                                 |                        |                         |                         |                          |                        |                             |
|             |              |             |                      |                                 |                        |                         |                         | Activity Noise Level     | 57                     |                             |

### Calculation 9

| Description                     | No. of Plant | SWL [dB(A)] | Closest Distance [m] | Percentage on time (1.0 = 100%) | ADJUSTMENT (dB(A))     |                         |                         |                          |                        | Resultant Noise Level dB(A) |
|---------------------------------|--------------|-------------|----------------------|---------------------------------|------------------------|-------------------------|-------------------------|--------------------------|------------------------|-----------------------------|
|                                 |              |             |                      |                                 | Distance Correction dB | No. of Plant Correction | Screening Correction dB | Reflection Correction dB | Duration Correction dB |                             |
| Concrete silo and ready mix lor | 6            | 103         | 250                  | 60%                             | -56.0                  | 7.8                     | 0                       | 3                        | -2.22                  | 55.6                        |
| Diesel generators               | 12           | 88          | 250                  | 100%                            | -56.0                  | 10.8                    | 0                       | 3                        | 0.00                   | 45.8                        |
| Concrete pumps                  | 12           | 95          | 250                  | 100%                            | -56.0                  | 10.8                    | 0                       | 3                        | 0.00                   | 52.8                        |
| Hydraulic cutters               | 6            | 111         | 250                  | 60%                             | -56.0                  | 7.8                     | 0                       | 3                        | -2.22                  | 63.6                        |
| Hydraulic access platrofm       | 6            | 95          | 250                  | 60%                             | -56.0                  | 7.8                     | 0                       | 3                        | -2.22                  | 47.6                        |
| HGV                             | 1            | 108         | 250                  | 25%                             | -56.0                  | 0.0                     | 0                       | 3                        | -6.02                  | 49.0                        |
|                                 |              |             |                      |                                 |                        |                         |                         |                          |                        |                             |
|                                 |              |             |                      |                                 |                        |                         |                         |                          |                        |                             |
|                                 |              |             |                      |                                 |                        |                         |                         | Activity Noise Level     | 65                     |                             |

### Calculation 10

| Description                     | No. of Plant | SWL [dB(A)] | Closest Distance [m] | Percentage on time (1.0 = 100%) | ADJUSTMENT (dB(A))     |                         |                         |                          |                        | Resultant Noise Level dB(A) |
|---------------------------------|--------------|-------------|----------------------|---------------------------------|------------------------|-------------------------|-------------------------|--------------------------|------------------------|-----------------------------|
|                                 |              |             |                      |                                 | Distance Correction dB | No. of Plant Correction | Screening Correction dB | Reflection Correction dB | Duration Correction dB |                             |
| Concrete silo and ready mix lor | 6            | 103         | 130                  | 60%                             | -50.3                  | 7.8                     | 0                       | 3                        | -2.22                  | 61.3                        |
| Diesel generators               | 12           | 88          | 130                  | 100%                            | -50.3                  | 10.8                    | 0                       | 3                        | 0.00                   | 51.5                        |
| Concrete pumps                  | 12           | 95          | 130                  | 100%                            | -50.3                  | 10.8                    | 0                       | 3                        | 0.00                   | 58.5                        |
| Hydraulic cutters               | 6            | 111         | 130                  | 60%                             | -50.3                  | 7.8                     | 0                       | 3                        | -2.22                  | 69.3                        |
| Hydraulic access platrofm       | 6            | 95          | 130                  | 60%                             | -50.3                  | 7.8                     | 0                       | 3                        | -2.22                  | 53.3                        |
| HGV                             | 1            | 108         | 130                  | 25%                             | -50.3                  | 0.0                     | 0                       | 3                        | -6.02                  | 54.7                        |
|                                 |              |             |                      |                                 |                        |                         |                         |                          |                        |                             |
|                                 |              |             |                      |                                 |                        |                         |                         |                          |                        |                             |
|                                 |              |             |                      |                                 |                        |                         |                         | Activity Noise Level     | 70                     |                             |

### Calculation 11

| Description                     | No. of Plant | SWL [dB(A)] | Closest Distance [m] | Percentage on time (1.0 = 100%) | ADJUSTMENT (dB(A))     |                         |                         |                          |                        | Resultant Noise Level dB(A) |
|---------------------------------|--------------|-------------|----------------------|---------------------------------|------------------------|-------------------------|-------------------------|--------------------------|------------------------|-----------------------------|
|                                 |              |             |                      |                                 | Distance Correction dB | No. of Plant Correction | Screening Correction dB | Reflection Correction dB | Duration Correction dB |                             |
| Concrete silo and ready mix lor | 6            | 103         | 100                  | 60%                             | -48.0                  | 7.8                     | 0                       | 3                        | -2.22                  | 63.6                        |
| Diesel generators               | 12           | 88          | 100                  | 100%                            | -48.0                  | 10.8                    | 0                       | 3                        | 0.00                   | 53.8                        |
| Concrete pumps                  | 12           | 95          | 100                  | 100%                            | -48.0                  | 10.8                    | 0                       | 3                        | 0.00                   | 60.8                        |
| Hydraulic cutters               | 6            | 111         | 100                  | 60%                             | -48.0                  | 7.8                     | 0                       | 3                        | -2.22                  | 71.6                        |
| Hydraulic access platrofm       | 6            | 95          | 100                  | 60%                             | -48.0                  | 7.8                     | 0                       | 3                        | -2.22                  | 55.6                        |
| HGV                             | 1            | 108         | 100                  | 25%                             | -48.0                  | 0.0                     | 0                       | 3                        | -6.02                  | 57.0                        |
|                                 |              |             |                      |                                 |                        |                         |                         |                          |                        |                             |
|                                 |              |             |                      |                                 |                        |                         |                         |                          |                        |                             |
|                                 |              |             |                      |                                 |                        |                         |                         | Activity Noise Level     | 73                     |                             |

### Calculation 12

| Description               | No. of Plant | SWL [dB(A)] | Closest Distance [m] | Percentage on time (1.0 = 100%) | ADJUSTMENT (dB(A))     |                         |                         |                          |                        | Resultant Noise Level dB(A) |
|---------------------------|--------------|-------------|----------------------|---------------------------------|------------------------|-------------------------|-------------------------|--------------------------|------------------------|-----------------------------|
|                           |              |             |                      |                                 | Distance Correction dB | No. of Plant Correction | Screening Correction dB | Reflection Correction dB | Duration Correction dB |                             |
| Mobile crane              | 6            | 105         | 250                  | 60%                             | -56.0                  | 7.8                     | 0                       | 3                        | -2.22                  | 57.6                        |
| Hand held tools           | 6            | 103         | 250                  | 60%                             | -56.0                  | 7.8                     | 0                       | 3                        | -2.22                  | 55.6                        |
| Diesel generators         | 12           | 88          | 250                  | 100%                            | -56.0                  | 10.8                    | 0                       | 3                        | 0.00                   | 45.8                        |
| Hydraulic cutters         | 6            | 111         | 250                  | 60%                             | -56.0                  | 7.8                     | 0                       | 3                        | -2.22                  | 63.6                        |
| Hydraulic access platrofm | 6            | 95          | 250                  | 60%                             | -56.0                  | 7.8                     | 0                       | 3                        | -2.22                  | 47.6                        |
| Concrete pumps            | 12           | 95          | 250                  | 100%                            | -56.0                  | 10.8                    | 0                       | 3                        | 0.00                   | 52.8                        |
| HGV                       | 1            | 108         | 250                  | 5%                              | -56.0                  | 0.0                     | 0                       | 3                        | -13.01                 | 42.0                        |
|                           |              |             |                      |                                 |                        |                         |                         |                          |                        |                             |
|                           |              |             |                      |                                 |                        |                         |                         |                          |                        |                             |
|                           |              |             |                      |                                 |                        |                         |                         | Activity Noise Level     | 65                     |                             |

## Calculation 13

| Description               | No. of Plant | SWL [dB(A)] | Closest Distance [m] | Percentage on time (1.0 = 100%) | ADJUSTMENT (dB(A))     |                         |                         |                          |                        | Resultant Noise Level dB(A) |
|---------------------------|--------------|-------------|----------------------|---------------------------------|------------------------|-------------------------|-------------------------|--------------------------|------------------------|-----------------------------|
|                           |              |             |                      |                                 | Distance Correction dB | No. of Plant Correction | Screening Correction dB | Reflection Correction dB | Duration Correction dB |                             |
| Mobile crane              | 6            | 105         | 130                  | 60%                             | -50.3                  | 7.8                     | 0                       | 3                        | -2.22                  | 63.3                        |
| Hand held tools           | 6            | 103         | 130                  | 60%                             | -50.3                  | 7.8                     | 0                       | 3                        | -2.22                  | 61.3                        |
| Diesel generators         | 12           | 88          | 130                  | 100%                            | -50.3                  | 10.8                    | 0                       | 3                        | 0.00                   | 51.5                        |
| Hydraulic cutters         | 6            | 111         | 130                  | 60%                             | -50.3                  | 7.8                     | 0                       | 3                        | -2.22                  | 69.3                        |
| Hydraulic access platofrm | 6            | 95          | 130                  | 60%                             | -50.3                  | 7.8                     | 0                       | 3                        | -2.22                  | 53.3                        |
| Concrete pumps            | 12           | 95          | 130                  | 100%                            | -50.3                  | 10.8                    | 0                       | 3                        | 0.00                   | 58.5                        |
| HGV                       | 1            | 108         | 130                  | 5%                              | -50.3                  | 0.0                     | 0                       | 3                        | -13.01                 | 47.7                        |
|                           |              |             |                      |                                 |                        |                         |                         |                          |                        |                             |
|                           |              |             |                      |                                 |                        |                         |                         |                          |                        |                             |
|                           |              |             |                      |                                 |                        |                         |                         | Activity Noise Level     | 71                     |                             |

### Calculation 14

| Description               | No. of Plant | SWL [dB(A)] | Closest Distance [m] | Percentage on time (1.0 = 100%) | ADJUSTMENT (dB(A))     |                          |                         |                          |                        | Resultant Noise Level dB(A) |
|---------------------------|--------------|-------------|----------------------|---------------------------------|------------------------|--------------------------|-------------------------|--------------------------|------------------------|-----------------------------|
|                           |              |             |                      |                                 | Distance Correction dB | No. of Plant Correctio n | Screening Correction dB | Reflection Correction dB | Duration Correction dB |                             |
| Mobile crane              | 6            | 105         | 100                  | 60%                             | -48.0                  | 7.8                      | 0                       | 3                        | -2.22                  | 65.6                        |
| Hand held tools           | 6            | 103         | 100                  | 60%                             | -48.0                  | 7.8                      | 0                       | 3                        | -2.22                  | 63.6                        |
| Diesel generators         | 12           | 88          | 100                  | 100%                            | -48.0                  | 10.8                     | 0                       | 3                        | 0.00                   | 53.8                        |
| Hydraulic cutters         | 6            | 111         | 100                  | 60%                             | -48.0                  | 7.8                      | 0                       | 3                        | -2.22                  | 71.6                        |
| Hydraulic access platrofm | 6            | 95          | 100                  | 60%                             | -48.0                  | 7.8                      | 0                       | 3                        | -2.22                  | 55.6                        |
| Concrete pumps            | 12           | 95          | 100                  | 100%                            | -48.0                  | 10.8                     | 0                       | 3                        | 0.00                   | 60.8                        |
| HGV                       | 1            | 108         | 100                  | 5%                              | -48.0                  | 0.0                      | 0                       | 3                        | -13.01                 | 50.0                        |
|                           |              |             |                      |                                 |                        |                          |                         |                          |                        |                             |
|                           |              |             |                      |                                 |                        |                          |                         |                          |                        |                             |
|                           |              |             |                      |                                 |                        |                          |                         | Activity Noise Level     | 73                     |                             |